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FINAL FOCUSED FEASIBILITY STUDY REPORT ADDENDUM SITE 2 NAS PENSACOLA FL
10/1/2004
ENSAFE/ALLEN AND HOSHALL

FINAL FOCUSED FEASIBILITY STUDY REPORT ADDENDUM
SITE 2 — WATERFRONT SEDIMENTS
NAS PENSACOLA
PENSACOLA, FLORIDA

SOUTHNAVFACENGCOM
Contract Number: N62467-89-D-0318
CTO-059

Prepared for:

Naval Facilities Engineering Command
SOUTHERN DIVISION

Comprehensive Long-Term Environmental Action Navy (CLEAN)
Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

Prepared by:

EnSafe Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134
(901) 372-7962
www.ensafe.com

October 1, 2004

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The Contractor, EnSafe Inc. hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0318 is complete, accurate, and complies with all requirements of the contract.

Date:	**October 1, 2004**
Signature:	
Name:	**Allison Harris**
Title:	**Task Order Manager**

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List of Abbreviations

The following list contains many of the abbreviations, acronyms and symbols used in this report.

ARAR	Applicable or Relevant and Appropriate Requirement
BEHP	Bis(2-Ethylhexyl)phthalate
BRA	Baseline Risk Assessment
CDF	Confined Disposal Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COPC	Chemical of Potential Concern
DU	Decision Unit
ERL	Effects Range Low
ERM	Effects Range Median
FDEP	Florida Department of Environmental Protection
FS	Feasibility study
FFS	Focused Feasibility Study
FFSA	Focused Feasibility Study Addendum
ft/s	foot/feet per second
LDR	Land Disposal Restriction
LTSM	Long-Term Sediment Monitoring
NADEP	Naval Aviation Depot
NARF	Naval Air Rework Facilities
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear Aromatic
PCB	Polychlorinated Biphenyls
PEL	Probable Effects Level
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal

RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendment Reauthorization Act of 1986
SEM/AVS	Simultaneously Extracted Metals/Acid Volatile Sulfides
SQAG	Sediment Quality Assessment Guideline
SQG	Sediment Quality Guideline
SQT	Sediment Quality Triad
SSV	Sediment Screening Values
SVOC	Semivolatile Organic Compound
TBC	to be considered
TEL	Threshold Effects Level
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UTS	Universal Treatment Standard
VOC	Volatile Organic Compound

Executive Summary

This Focused Feasibility Study Addendum (FFSA) develops, evaluates, and compares four remedial action alternatives that can be used to mitigate hazards and threats to the environment (ecological) at Site 2, Waterfront Sediments, (Operable Unit 3) at the Naval Air Station Pensacola. This FFSA addresses sediment only within two 150 foot by 150 foot areas identified during the remedial investigation.

Four primary alternatives were evaluated in this FFSA:

1. No action
2. Capping
3. Dredging and backfilling the surface sediment with offsite disposal of the dredged sediment
4. Long-term sediment monitoring (LTSM)

Alternatives were screened based on implementability, effectiveness, and cost. Retained alternatives were then analyzed as required by the National Contingency Plan based on the following nine criteria:

1. Overall protection of human health and the environment
2. Compliance with applicable or relevant and appropriate requirements (ARARs)
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

Threshold Criteria

No human health risks are expected at Site 2; therefore, no further action is required to protect human health. Each of the four alternatives protects the environment in varying degrees. No action allows the environment to function undisturbed. Capping and dredging afford long-term protection of the environment, but exterminate benthic organisms in the identified areas. LTSM detects changes to the environment in anticipation of decreasing risks through natural processes. All four alternatives comply with their identified ARARs.

Balancing Criteria

The capping and dredging alternatives provide more long-term effectiveness than the no-action or LTSM alternatives, but have adverse short-term impacts to benthic organisms. All alternatives are implementable. The estimated costs of capping and dredging are greater than \$1,000,000, whereas the estimated cost of LTSM and no action are \$190,000 and \$45,000, respectively.

Modifying Criteria

State acceptance criterion is largely satisfied through state involvement in the entire remedial process, including review of the FFSA. The community acceptance criteria will be established after the public comment period for the FFSA.

1.0 INTRODUCTION

1.1 Purpose and Organization

The purpose of this Focused Feasibility Study Addendum (FFSA) is to develop, evaluate, and compare remedial action alternatives that may be used to mitigate hazards and threats to the environment as a result of sediment contamination at Site 2 on the southeastern shoreline of Naval Air Station (NAS) Pensacola. The FFSA is being conducted under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendment Reauthorization Act (SARA) of 1986 based upon findings reported in the *Final Remedial Investigation Report Addendum, Naval Air Station Pensacola, Site 2* (EnSafe, 2004).

This FFSA report is organized in the format suggested in Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (Interim Final, October 1988). The only medium at Site 2 requiring attention is the near-shore sediment in Pensacola Bay; therefore, the scope of work and alternatives for Site 2 are limited. The focused feasibility study format is presented as follows:

- **Section 1, Introduction:** This section presents background information regarding the Remedial Investigation (RI), including the supplemental sampling performed in 2000, the baseline risk assessment (BRA), and the screening levels.

- **Section 2, Identification and Screening of Technologies:** This section presents the remedial elements of each alternative, along with its implementability, effectiveness, and cost.

- **Section 3, Detailed Analysis of Alternatives:** This section presents the detailed analysis of alternatives using the nine criteria specified in the *National Oil and Hazardous Substances Pollution Contingency Plan (NCP); Final Rule* (EPA/540/1-89/002, December 1989).

- **Section 4, Comparative Analysis of Alternatives:** This section compares the alternatives presented in the previous sections, providing decision-makers with a concise summary of differences among the alternatives.

1.2 Background Information

Site 2 is on the southeastern shoreline of NAS Pensacola in Escambia County, Florida. The site consists of an area of near-shore sediments along Pensacola Bay's waterfront. Figure 1-1 is a location map of Site 2 and vicinity. A concrete seawall, approximately 3 to 4 feet high, dominates the shoreline. Fifty-six sewer and industrial wastewater outfalls, ranging from 1 to 42 inches in diameter, were previously identified along the seawall (Ecology & Environment, 1991). The seawall also accommodates numerous scuppers (i.e., holes) to drain surface water runoff from the adjacent parking areas.

From 1939 to 1973, untreated industrial wastes from Naval Aviation Depot (NADEP) and Naval Air Rework Facilities (NARF) operations were routinely discharged into Pensacola Bay, near Site 2. Over 34 years, an estimated 83 million gallons of the following materials were disposed in the bay: waste-containing paint, paint solvents, thinners, ketones, trichloroethylene, Alodine, mercury, and concentrated plating wastes (primarily chromium, cadmium, lead, nickel, and cyanide) (Geraghty & Miller, 1984). Other potential impacts may have occurred from vessel operations at the pier and docking facilities in the immediate area. Additionally, because of transport mechanisms characteristic of open bay systems such as Pensacola Bay, offsite sources may also have impacted the site. In 1973, NAS Pensacola's industrial waste stream was diverted to an industrial wastewater treatment plant (Ecology & Environment, 1991, 1992a, 1992b) and the discharges to Site 2 ceased. Since 1973, numerous environmental studies have been conducted at Site 2 (in 1983, 1984, and 1986) to evaluate the extent of contamination. Although these studies were inconclusive, some contaminants were detected.

The Site 2 investigation, which began in 1993 and extended through 1996, included a Phase I sampling event to determine total organic carbon and grain-size distributions in sediments and a Phase II sampling event to assess contamination. During Phase II, sediment and surface water chemistry samples also were collected. There were two Phase II sampling events, termed A and B.

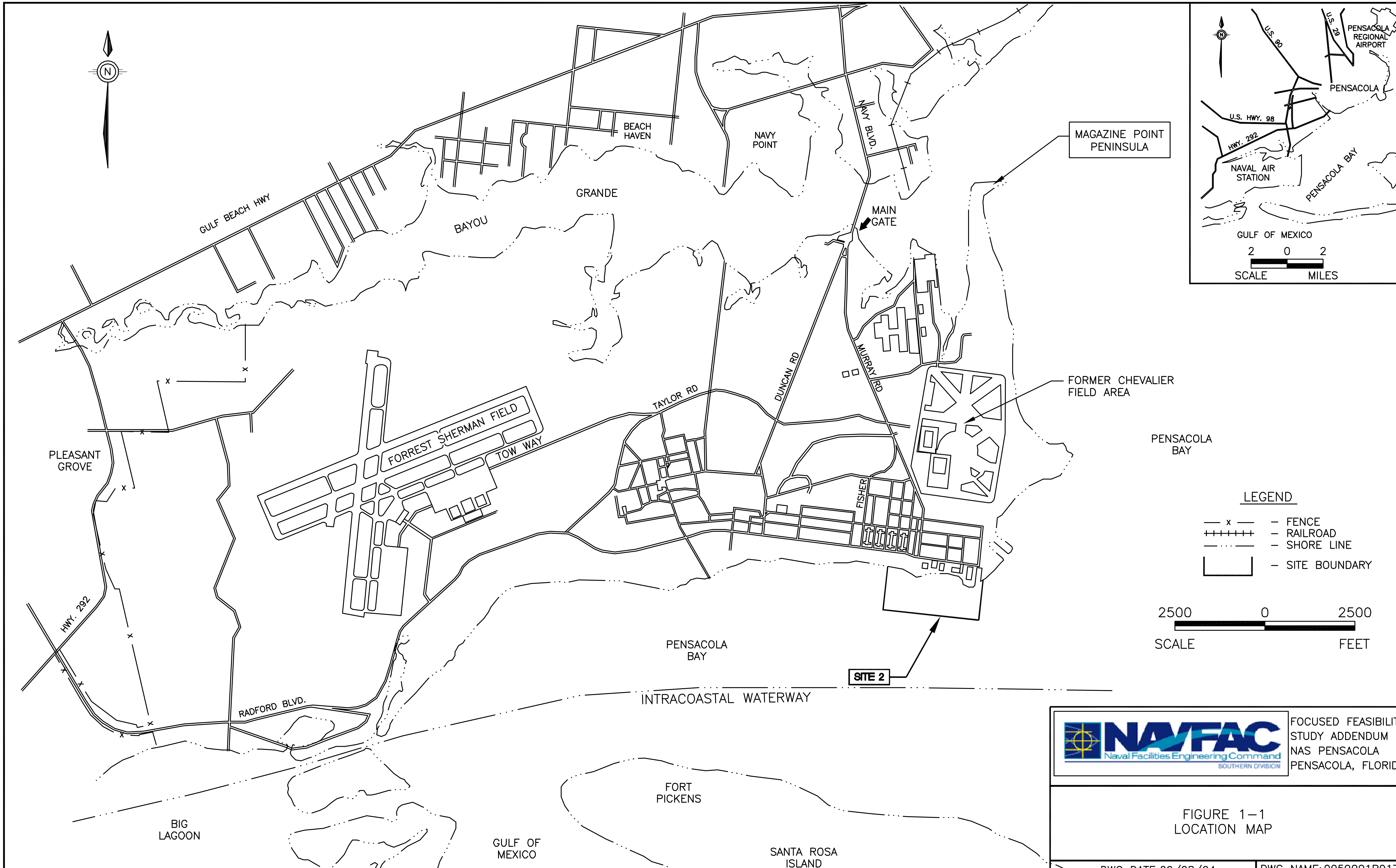

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FIGURE 1–1
LOCATION MAP

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During Phase IIA, contaminants and locations were specified for additional investigation in Phase IIB. The areas identified during Phase IIA were resampled for chemical analyses during Phase IIB (EnSafe, 2004). Based on analytical results from these sampling events, the "hot spots" (samples A2, F3, H1, H3, and I0; defined as having a hazard index greater than 10) were identified and the extent of contamination was delineated as shown on Figure 1-2.

A feasibility study (FS) was completed in 1997 that evaluated four remedial alternatives (no action, monitoring, capping, and dredging with offsite disposal) for the site. Concurrence on the FS report was received on December 22, 1997, from the Florida Department of Environmental Protection (FDEP). The proposed plan for the site stated that monitoring was the preferred alternative and a public comment period was held from December 8, 1997, to January 22, 1998. Only one comment was submitted by a community member. That comment suggested the Navy do a remedial action or nothing at the site instead of monitoring. After deliberation regarding this comment, the United States Environmental Protection Agency (USEPA), FDEP, the National Oceanographic and Atmospheric Administration (NOAA), and the Navy agreed to assess the current condition of Site 2 because three hurricanes (Erin, Opal, and Georges) had affected the area in the years following the original sampling event.

The March 2000 investigation, which is reported in the final RI Report Addendum (EnSafe, 2004), was conducted to determine if chemical constituents at Site 2 create adverse conditions for benthic communities. Because three hurricanes impacted the area after the 1996 sampling event, additional data were needed to assess the site conditions. Sediment contamination near samples F3, H1, H3, and I0 appears to be localized as a result of a rotational flow pattern, as evidenced by the siltation and flow patterns described in the 1996 RI report (EnSafe/Allen & Hoshall, 1996). Sediment was not evaluated near sample A2. In the data quality objectives, sediment contamination near sample A2 was stated to probably be attributed to boat traffic and is probably not associated with Site 2.

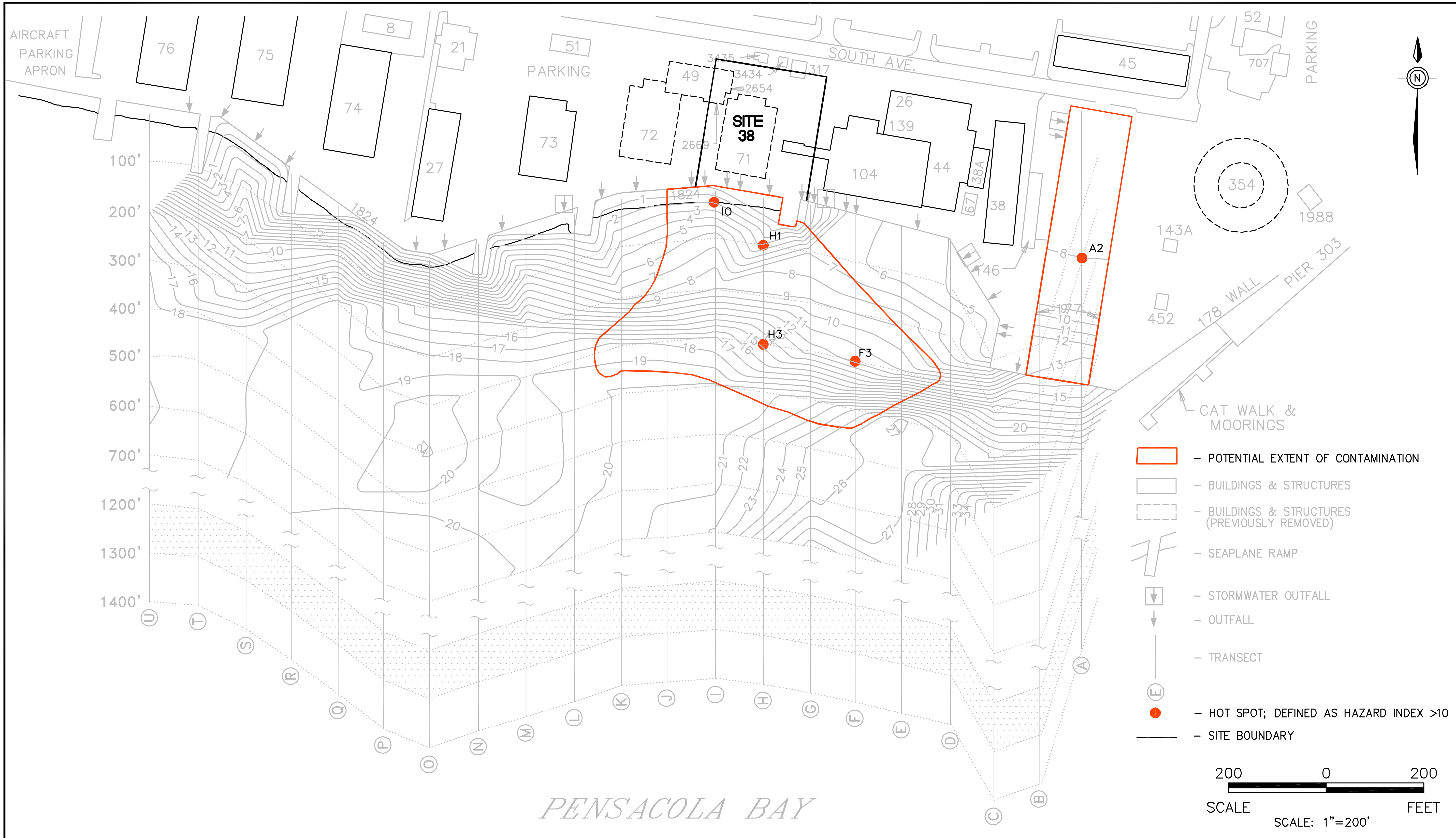

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FIGURE 1–2
EXTENT OF CONTAMINATION
BASED ON 1996 SAMPLING DATA

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A sampling grid was established to assess sediment contamination near the Site 2 "hot spot" contamination (i.e., samples F3, H1, H3, and I0) identified in 1996, shown on Figure 1-2. Eight decision units (DUs) — DU01 to DU08 — were established, covering the central area beginning at the seawall adjacent to the location of former Building 71 and extending offshore to the southeast. Three additional DUs (DU09 to DU11) were established to delineate potential contamination to the west, south, and east. The Site 2 decision units (DU01 to DU11) are shown in Figure 1-3. These DUs were defined using the transect system originally established for the site. As shown in Figure 1-3, the original, irregular sampling grid consists of 100-foot spaced parallel north-south, lettered transects and 100-foot interval transects parallel to the shoreline. The sampled grid cells are named based on this grid but are established as 150-foot square DUs. The nomenclature for the sample grid cells are based on the grid location (e.g., GH-34 intersects transects G, H, 300 feet, and 400 feet) and are referred to as station numbers (e.g., USEPA Station 4) or decision units (e.g., DU04).

Three surface sediment samples (0 to 6 inches) were collected by USEPA divers–from the southwest corner, the center, and the northeast corner at each DU. Corner samples were shared for DU02 and DU03, DU04 and DU06, and DU08 and DU11. Chemical samples were prepared as 3-point composite samples for each DU, whereas biological samples were prepared as undisturbed grab samples. A single subsurface sediment sample (6 to 36 inches) was attempted from the center of each DU. Subsurface samples were not collected in DU02, DU06, DU07, DU08, and DU10 because of core-sampler refusal. The March 2000 sample locations proposed in the sampling and analysis plan are shown in Figure 1-4. The sediment samples collected in 2000 were collected as composite samples for the sampling grid, and therefore, are not directly comparable with the grab samples collected in 1996. Stations 18 and 22, which are approximately 2,500 foot southeast and 15,000 foot northeast of Site 2 respectively, were sampled as offsite controls. Sediment sampling details are provided in *Final Report, Pensacola Naval Air Station, Sediment Survey, Operable Unit 3* (USEPA, 2001).

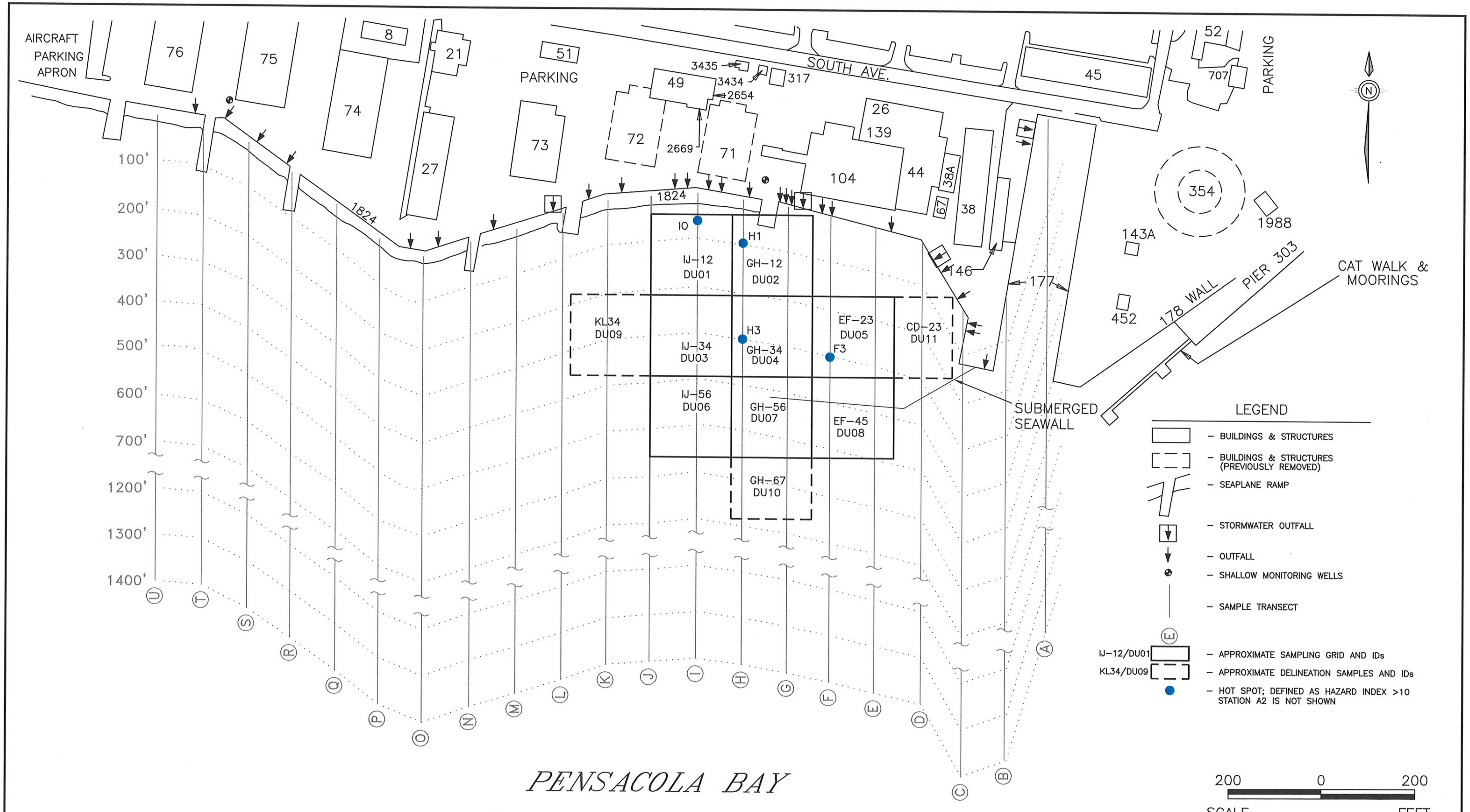

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FIGURE 1–3
DECISION UNITS FOR THE 2000 SAMPLING EVENT

DWG DATE:09/28/04 | NAME: 0059001B018

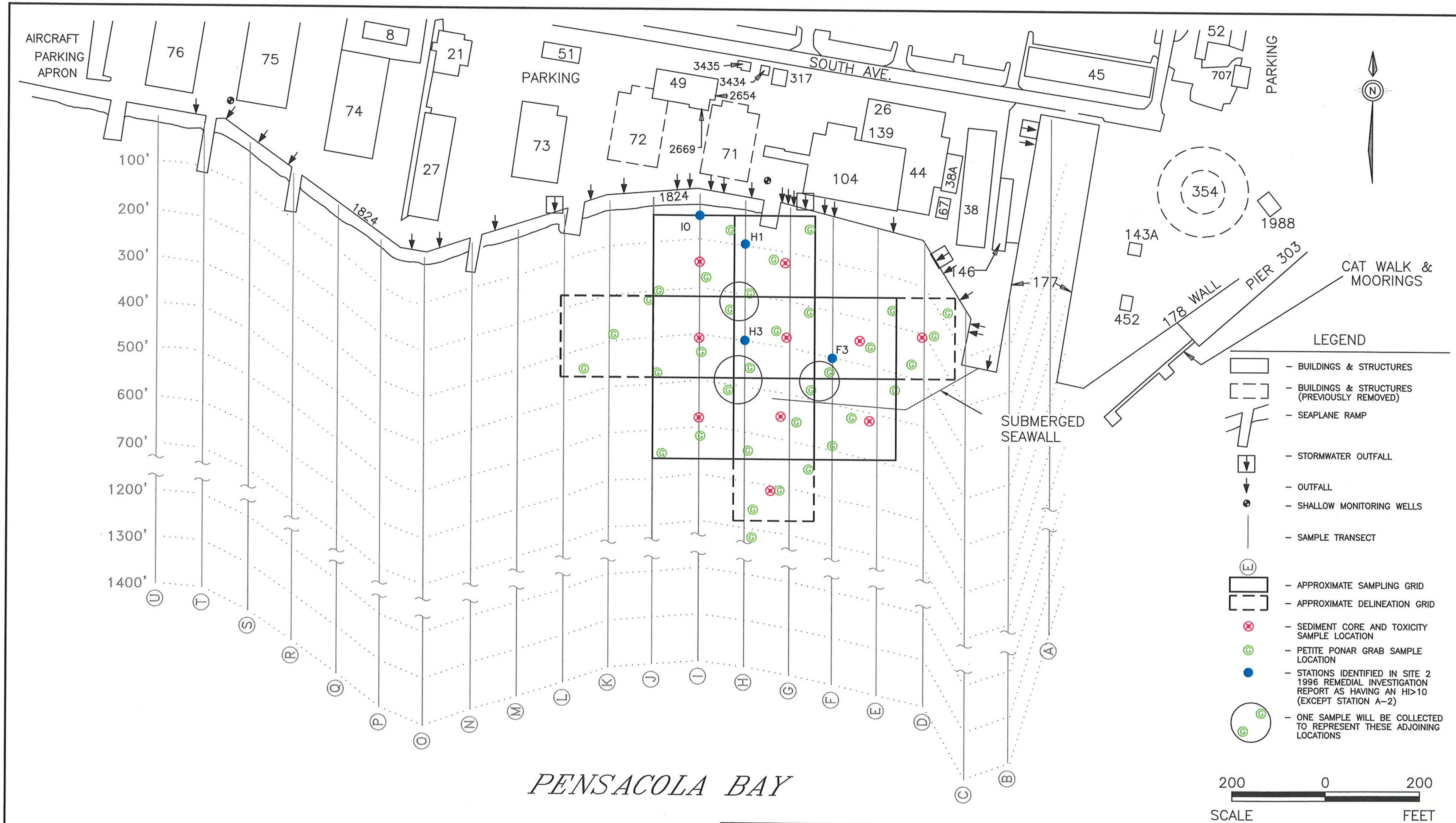

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FIGURE 1–4
2000 SAMPLING LOCATIONS

DWG DATE:04/25/05 | NAME: 0059001B014

1.2.1 Nature and Extent of Contamination

The nature and extent of contamination briefly summarized in this FFSA address surface water and sediment.

Surface Water: To assess potential environmental impacts, observed contaminant concentrations in surface water were compared to federal and state water-quality criteria. Analytical data collected during the RI indicate surface water is not contaminated at or near Site 2. According to the Final RI Report (E\A&H, 1996), few constituents in surface water exceeded established criteria. The only significant occurrence across the site was for silver; however, the reported silver concentrations are suspected to be a result of laboratory matrix interference from the high salinity water (per telephone conversation with laboratory personnel). Surface water analytical data from the 1996 RI sampling event show that Site 2 activities are not impacting this medium; therefore, additional surface water sampling was not performed in the 2000 event.

Sediment: The source of chemicals found in sediment at Site 2 in Pensacola Bay is a combination of wastewaters discharged to the bay, vessel operations at the pier and docking facilities in the area, numerous outfalls including storm water outfalls, and vessel traffic in the area. To assess both the nature and extent of contamination and the potential for excess ecological risk, surface sediment was evaluated using the sediment quality triad (SQT) (Chapman et al., 1997). The SQT is used for the integrated assessment of sediment quality based on three parameters: sediment chemistry, toxicity, and benthic community assessment. To apply the outcome of the two different toxicity tests (acute and chronic), species diversity and chemical data, assumptions and decision rules were agreed upon and the resultant input into the triad (i.e., + or —) established before sampling was conducted. Typically, a " +" was assigned when there was a measured difference between test and control or reference conditions. Alternatively, a "—" was input into the triad when there was no measurable difference between test and control or reference conditions.

Sediment chemistry data were compared with sediment quality guidelines (SQGs), including the FDEP probable effects level (PEL) and threshold effects level (TEL) and the effects range low (ERL) and the effects range medium (ERM) from a biological effects database (Long et al., 1995). The mean ERM quotient method for multiple COPCs was applied to the DUs (NOAA, 1999). Based on the mean ERM quotient, categories were assigned as outlined below.

- Category 1 — Mean ERM quotient <0.1
- Category 2 — Mean ERM quotient 0.11 – 0.5
- Category 3 — Mean ERM quotient 0.5 – 1.5
- Category 4 — Mean ERM quotient > 1.5

Category 1 is considered to be nontoxic while Category 4 has the greatest probability of toxicity. Categories 2 and 3 have the greatest uncertainty as to the relationship with toxicity; however, for the Site 2 investigation, sediments were considered to have adverse sediment chemistry when the mean ERM quotient exceeded 0.1. Using these criteria, DU01, DU04, DU05, DU08, and DU11 were conservatively considered impacted for the chemical parameter and were scored "+". The surface sediment chemistry data and mean ERM quotients are summarized in Table 1-1. Sediments were also analyzed for simultaneously extracted metals/acid volatile sulfides (SEM/AVS) to assess the bioavailability of metals. The AVS/SEM data indicated probable bioavailability at DU11. Bioavailabilty of metals was also possible at DU02 and DU10, although there was not concordance between the two trace methods (EnSafe, 2004).

Toxicity was evaluated by performing 10-day *Leptocheirus plumulosus* and 7-day *Mysidopsis bahia* sediment bioassays, which each provided measures of survival and growth and the latter provided a measure of reproduction. Results are presented in Table 1-2. When a DU had an unacceptable survival (defined as less than 80%) or two statistically significant differences for sublethal effects, it was considered impacted. Using these criteria, DU08 and DU11 had survivals less than 80% and were scored "+".

Table 1-1
Surface Sediment ERM Quotients and Mean ERM Quotients

		DU01		DU02		DU03		DU04		DU05		DU06		DU07		DU08		DU09		DU10		DU11					
		IJ-12		GH-12		IJ-34		GH-34		EF-23		IJ-56		GH-56		EF-45		KL-34		GH-67		CD-23		Reference			
PARAMETERS	**ERMs**	**SD00101**	**HQ**	**SD00201**	**HQ**	**SD00301**	**HQ**	**SD00401**	**HQ**	**SD00501**	**HQ**	**SD00601**	**HQ**	**SD00701**	**HQ**	**SD00801**	**HQ**	**SD00901**	**HQ**	**SD01001**	**HQ**	**SD01101**	**HQ**	**SD01801**	**HQ**	**SD02201**	**HQ**
Metals (mg/kg)																											
Arsenic	70	4.9	0.07	1.5	0.02	12	0.17	11	0.16	16	0.23	2.6	0.04	3.4	0.05	6.9	0.10	14	0.20	0.52	0.01	9.1	0.13	5	0.07	18	0.26
Cadmium	9.6	2.3	0.24	0.17	0.02	1.7	0.18	5.2	0.54	4.3	0.45	0.07	0.01	0.1	0.01	0.17	0.02	0.39	0.04	0.0205	0.00	1.3	0.14	0.075	0.01	0.22	0.02
Chromium	370	100	0.27	8.9	0.02	39	0.11	38	0.10	75	0.20	6.8	0.02	13	0.04	19	0.05	39	0.11	1.2	0.00	41	0.11	13	0.04	50	0.14
Copper	270	25	0.09	11	0.04	14	0.05	27	0.10	66	0.24	3.4	0.01	4.4	0.02	8.8	0.03	23	0.09	0.56	0.00	48	0.18	3.7	0.01	13	0.05
Lead	218	190	0.87	16	0.07	47	0.22	51	0.23	640	**2.94**	15	0.07	12	0.06	17	0.08	27	0.12	1.1	0.01	150	0.69	5.7	0.03	24	0.11
Nickel	51.6	3.3	0.06	1.1	0.02	8.7	0.17	10	0.19	7.8	0.15	2.1	0.04	2.4	0.05	6.1	0.12	9.8	0.19	0.34	0.01	5.2	0.10	3.7	0.07	14	0.27
Silver	3.7	0.077	0.02	0.0275	0.01	0.06	0.02	0.11	0.03	0.21	0.06	0.03	0.01	0.033	0.01	0.0475	0.01	0.075	0.02	0.027	0.01	0.2	0.05	0.036	0.01	0.075	0.02
Total Mercury	0.71	0.086	0.12	0.036	0.05	0.085	0.12	0.082	0.12	0.21	0.30	0.018	0.03	0.026	0.04	0.044	0.06	0.075	0.11	0.00375	0.01	0.16	0.23	0.019	0.03	0.11	0.15
Zinc	410	75	0.18	14	0.03	55	0.13	59	0.14	670	**1.63**	17	0.04	19	0.05	34	0.08	52	0.13	2.5	0.01	79	0.19	13	0.03	70	0.17
Pesticides (μg/kg)																											
4,4'-DDE (P,P'-DDE)	27	0.52	0.02	0.46	0.02	1.1	0.04	0.92	0.03	0.75	0.03	0.48	0.02	0.52	0.02	0.77	0.03	1.2	0.04	0.4	0.01	0.65	0.02	0.57	0.02	1.1	0.04
4,4'-DDT (P,P'-DDT)	46.1	0.52	0.01	0.46	0.01	1.1	0.02	0.92	0.02	0.75	0.02	0.48	0.01	0.52	0.01	1.8	0.04	1.2	0.03	0.4	0.01	0.65	0.01	0.57	0.01	1.1	0.02
Total PCBs (μg/kg)	180	287.8	**1.60**	36.9	0.21	88	0.49	98	0.54	157	0.87	38.5	0.21	41.2	0.23	62.2	0.35	96	0.53	32.2	0.18	52	0.29	46.2	0.26	89	0.49
PAHs (μg/kg)																											
2-Methylnaphthalene	670	28	0.04	22	0.03	4.65	0.01	43	0.06	41.5	0.06	8.6	0.01	2.65	0.00	38	0.06	6	0.01	2.15	0.00	31	0.05	2.9	0.00	6	0.01
Acenaphthene	500	85	0.17	65	0.13	14	0.03	22.5	0.05	125	0.25	7.5	0.02	8	0.02	115	0.23	19	0.04	6.5	0.01	95	0.19	9	0.02	18	0.04
Acenaphthylene	640	140	0.22	110	0.17	23	0.04	210	0.33	205	0.32	12	0.02	13	0.02	185	0.29	30.5	0.05	10.5	0.02	150	0.23	14	0.02	29	0.05
Anthracene	1100	28	0.03	18	0.02	9.8	0.01	45	0.04	59	0.05	2	0.00	11	0.01	42	0.04	22	0.02	0.375	0.00	43	0.04	0.495	0.00	29	0.03
Benzo(a)anthracene	1600	100	0.06	95	0.06	49	0.03	160	0.10	310	0.19	8.4	0.01	41	0.03	210	0.13	85	0.05	0.69	0.00	240	0.15	2.7	0.00	95	0.06
Benzo(a)pyrene	1600	160	0.10	86	0.05	62	0.04	180	0.11	440	0.28	9.7	0.01	45	0.03	240	0.15	110	0.07	1.1	0.00	410	0.26	3.8	0.00	120	0.08
Chrysene	2800	280	0.10	240	0.09	93	0.03	350	0.13	1000	0.36	20	0.01	92	0.03	380	0.14	170	0.06	1.6	0.00	630	0.23	6.1	0.00	210	0.08
Dibenz(a,h)anthracene	260	35	0.13	9	0.03	15	0.06	44	0.17	110	0.42	2.9	0.01	11	0.04	56	0.22	26	0.10	0.9	0.00	100	0.38	1.2	0.00	31	0.12
Fluoranthene	5100	210	0.04	61	0.01	91	0.02	300	0.06	710	0.14	16	0.00	66	0.01	570	0.11	180	0.04	0.65	0.00	470	0.09	6.8	0.00	250	0.05
Fluorene	540	10.5	0.02	8.5	0.02	1.75	0.00	16	0.03	15.5	0.03	0.9	0.00	1	0.00	14.5	0.03	2.35	0.00	0.8	0.00	11.5	0.02	1.1	0.00	13	0.02
Naphthalene	2100	180	0.09	45.5	0.02	71	0.03	90	0.04	85	0.04	18	0.01	62	0.03	160	0.08	110	0.05	4.5	0.00	130	0.06	17	0.01	12.5	0.01
Phenanthrene	1500	97	0.06	52	0.03	39	0.03	130	0.09	230	0.15	7.8	0.01	35	0.02	140	0.09	62	0.04	0.5	0.00	160	0.11	3.2	0.00	130	0.09
Pyrene	2600	240	0.09	99	0.04	91	0.04	270	0.10	720	0.28	21	0.01	71	0.03	560	0.22	160	0.06	1.8	0.00	440	0.17	6.7	0.00	200	0.08
Total ERM Quotients			**4.72**		**1.23**		**2.07**		**3.52**		**9.69**		**0.61**		**0.84**		**2.74**		**2.19**		**0.29**		**4.12**		**0.66**		**2.44**
Mean ERM Quotient			**0.19**		**0.05**		**0.08**		**0.14**		**0.39**		**0.02**		**0.03**		**0.11**		**0.09**		**0.01**		**0.16**		**0.03**		**0.10**
Number of ERM Exceedances			**1**		**0**		**0**		**0**		**2**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Category			**2**		**1**		**1**		**2**		**2**		**1**		**1**		**2**		**1**		**1**		**2**		**1**		**2**
Input into Triad			**+**		**—**		**—**		**+**		**+**		**—**		**—**		**+**		**—**		**—**		**+**		**—**		**+**

Notes:
One-half the detection limit has been used for parameters that were not detected, except for total PCBs and pesticides which used one-tenth the detection limit (See EPA report in Appendix B).
Concentrations exceeding the ERM are shown in **bold**.

Table 1-2
Toxicity Test Results Input Into Matrix

	Stations										Reference Stations		
	DU01	**DU02**	**DU03**	**DU04**	**DU05**	**DU06**	**DU07**	**DU08**	**DU09**	**DU10**	**DU11**	**18**	**22**
						Mysid							
Survival (%)	100	100	97	97	97	97	97	97	95	84	100	90	92
Growth (mg/mysid)	0.36	0.34	0.39	0.35	0.34	0.53	0.4	0.37	0.34	0.3	0.47	0.28	0.32
Reproduction (%)	85	92	94	100	67	94	88	75	88	69	95	93	22
Mysid Scoring	—	—	—	—	—	—	—	—	—	—	—	—	—
						Leptocheirus							
Survival (%)	89	88	95	95	95	81*[a]	82	73*	97	99	78*	98	96
Growth (mg/amphipod)	0.13*	0.14*	0.25	0.21	0.16	0.21	0.28	0.24	0.27	0.13*	0.27	0.12*	0.14*
Leptocheirus Scoring	+	+	—	—	—	—	—	++	—	+	++	—	—
Score for Triad Input	—	—	—	—	—	—	—	+	—	—	+	—	—

Notes:

mg/mysid	=	milligrams per mysid
mg/amp	=	milligrams per amphipod
a	=	Although station IJ-56 was identified as being significantly different, the station met the 80% survival criteria, therefore, a — was used for scoring since the sublethal endpoint did not show a significant difference from control.

Survival > 80% is considered acceptable

*	=	statistically significant difference from control
Reproduction	=	50% or more of the females were gravid indicating a valid test.

The benthos was evaluated by measuring the benthic diversity in the sediments. Based on indices of benthic diversity, evenness, and richness, the Site 2 sediments outperformed control Stations 18 and 22. This may have been attributable to the deeper depths and lower salinity of the reference stations. Nevertheless, none of the DUs were determined to be adversely impacted for the benthos parameter and were scored "—" as shown in Table 1-3.

The analyses, criteria, and evaluations are detailed in the *Final Remedial Investigation Addendum, Site 2 Waterfront Sediments* (EnSafe, 2004). The results of the sediment chemistry, toxicity tests, and benthic assessment were used to determine the condition of the sediment in each DU. The matrix for assessing the results is defined and described in Table 1-4. Table 1-5 presents the results of the sediment chemistry, toxicity, and benthic assessment parameters and the corresponding sediment condition. Based on the decision-making process established in the *Final Remedial Investigation Addendum, Site 2 Waterfront Sediments* (EnSafe, 2004), sediment conditions 2 and 3 require no further action. Thus, only decision units DU08 and DU11 require a feasibility study assessment.

Subsurface sediment samples were also assessed using the mean ERM quotient methods for comparison to surface sediments. Subsurface sediment chemistry, mean ERM quotient and categories are summarized in Table 1-6. Five of the eight subsurface stations revealed mean ERM quotients of greater than 0.1 resulting in a classification of Category 2. Four of these have greater values than the surface station counterparts as shown in Table 1-7.

Table 1-3
Benthic Assessment and Input into the Sediment Quality Triad

Stations	Diversity	Evenness	Richness	Benthic Community to Triad
DU01 IJ-12	3.04	0.77	9.87	—
DU02 GH-12	2.90	0.77	8.83	—
DU03 IJ-34	3.25	0.85	8.83	—
DU04 GH-34	3.17	0.82	8.30	—
DU05 EF-23	2.87	0.76	8.28	—
DU06 IJ-56	3.25	0.84	8.53	—

Table 1-3
Benthic Assessment and Input into the Sediment Quality Triad

Stations	Diversity	Evenness	Richness	Benthic Community to Triad
DU07 GH-56	3.16	0.83	8.47	—
DU08 EF-45	3.05	0.75	10.22	—
DU09 KL-34	3.11	0.80	8.88	—
DU10 GH-67	3.06	0.90	6.74	—
DU11 CD-23	3.04	0.82	8.26	—
18	2.81	0.76	6.84	—
22	2.57	0.87	4.53	—

Notes:
Acceptable = —
Not Acceptable = +

Table 1-4
Project Decision-Making Triad Matrix

Condition	Sediment Chemistry	Toxicity Tests	Benthic Assessment	Interpretation
1	+	+	+	Strong evidence for pollution-induced degradation.
2	—	—	—	Strong evidence for absence of pollution-induced degradation.
3	+	—	—	Contaminants are not bioavailable.
4	—	+	—	Unmeasured contaminants or conditions exist that have the potential to cause degradation.
5	—	—	+	Alteration of benthic community is probably not due to toxic chemical contamination.
6	+	+	—	Toxic chemicals are probably stressing the system.
7	—	+	+	Unmeasured toxic chemicals are causing degradation.
8	+	—	+	Benthic community degraded by toxic chemicals but toxicity tests not sensitive to toxic chemicals present or chemicals are not bioavailable, or alteration is not due to toxic chemicals.

Notes:
— = Measured difference between test and control or reference conditions
\+ = No measurable difference between test and control or reference conditions

Table 1-5
Surface Sediment Summary as Applied to the Triad

Station	Sediment Chemistry	Toxicity Tests	Benthic Assessment	Condition	Interpretation
IJ-12 USEPA 1 DU01	+	—	—	3	Contaminants are not bioavailable.
GH-12 USEPA 2 DU02	—	—	—	2	Strong evidence for absence of pollution-induced degradation.
IJ-34 USEPA 3 DU03	—	—	—	2	Strong evidence for absence of pollution-induced degradation.
GH-34 USEPA 4 DU04	+	—	—	3	Contaminants are not bioavailable.
EF-23 USEPA 5 DU05	+	—	—	3	Contaminants are not bioavailable.
IJ-56 USEPA 6 DU06	—	—	—	2	Strong evidence for absence of pollution-induced degradation.
GH-56 USEPA 7 DU07	—	—	—	2	Strong evidence for absence of pollution-induced degradation.
EF-45 USEPA 8 DU08	+	+	—	6	Toxic chemicals are probably stressing the system.
KL-34 USEPA 9 DU09	—	—	—	2	Strong evidence for absence of pollution-induced degradation.
GH-67 USEPA 10 DU10	—	—	—	2	Strong evidence for absence of pollution-induced degradation.
CD-23 USEPA 11 DU11	+	+	—	6	Toxic chemicals are probably stressing the system.
18	—	—	—	2	Strong evidence for absence of pollution-induced degradation.
22	+	—	—	2	Strong evidence for absence of pollution-induced degradation.

Notes:
OK = —
Not OK = +
Sediment Chemical
Mean ERM Quotient of 2 = +
Mean ERM Quotient of 1 = —

Table 1-6
Subsurface Sediment ERM Quotients and Mean ERM Quotients

		DU01		**DU03**		**DU04**		**DU05**		**DU09**		**DU11**		**Reference Stations**			
		IJ-12		**IJ-34**		**GH-34**		**EF-23**		**KL-34**		**CD-23**		**18**		**22**	
Parameters	**ERMs**	**SD00102**	**HQ**	**SD00302**	**HQ**	**SD00402**	**HQ**	**SD00502**	**HQ**	**SD00902**	**HQ**	**SD01102**	**HQ**	**SD01802**	**HQ**	**SD02202**	**HQ**
Metals (mg/kg)																	
Arsenic	70	14	0.2	16	0.23	12	0.17	12	0.17	16	0.23	18	0.26	5.1	0.07	17	0.24
Cadmium	9.6	0.1	0.01	2.9	0.30	0.46	0.05	0.49	0.05	0.36	0.04	0.77	0.08	0.087	0.01	0.25	0.03
Chromium	370	39	0.11	99	0.27	14	0.04	36	0.10	48	0.13	49	0.13	12	0.03	49	0.13
Copper	270	50	0.19	29	0.11	14	0.05	52	0.19	19	0.07	75	0.28	3.4	0.01	13	0.05
Lead	218	52	0.24	140	0.64	230	**1.06**	63	0.29	36	0.17	200	0.92	5.6	0.03	24	0.11
Nickel	51.6	12	0.23	13	0.25	5.4	0.10	11	0.21	13	0.25	15	0.29	3.7	0.07	13	0.25
Silver	3.7	0.07	0.02	2.2	0.59	0.0335	0.01	0.055	0.01	0.065	0.02	0.065	0.02	0.0325	0.01	0.06	0.02
Total Mercury	0.71	0.21	0.30	0.24	0.34	0.25	0.35	0.46	0.65	0.74	**1.04**	0.81	**1.14**	0.021	0.03	0.1	0.14
Zinc	410	51	0.12	130	0.32	41	0.10	50	0.12	77	0.19	95	0.23	12	0.03	62	0.15
Pesticides (μg/kg)																	
4,4'-DDE (P,P'-DDE)	27	NS	NC	5	0.19	2.4	0.09	4.85	0.18	5	0.19	4.85	0.18	2.4	0.09	4.45	0.16
4,4'-DDT (P,P'-DDT)	46.1	NS	NC	5	0.11	2.4	0.05	4.85	0.11	5	0.11	1.8	0.04	2.4	0.05	1.2	0.03
Total PCBs (μg/kg)	**180**	NS	NC	119	0.66	33.7	0.19	68.5	0.38	71	0.39	68.5	0.38	33.7	0.19	62.5	0.35
PAHs (μg/kg)																	
2-Methylnaphthalene	670	5	0.01	50	0.07	27	0.04	46	0.07	5.5	0.01	50	0.07	2.6	0.00	4.65	0.01
Acenaphthene	500	15.5	0.03	155	0.31	80	0.16	140	0.28	16.5	0.03	160	0.32	8	0.02	14.5	0.03
Acenaphthylene	640	24.5	0.04	250	0.39	130	0.20	225	0.35	26.5	0.04	255	0.40	13	0.02	23	0.04
Anthracene	1100	17	0.02	64	0.06	42	0.04	35	0.03	25	0.02	91	0.08	3	0.00	22	0.02
Benzo(a)anthracene	1600	90	0.06	360	0.23	120	0.08	130	0.08	110	0.07	390	0.24	14	0.01	99	0.06
Benzo(a)pyrene	1600	100	0.06	460	0.29	160	0.10	160	0.10	140	0.09	460	0.29	22	0.01	120	0.08
Chrysene	2800	160	0.06	850	0.30	260	0.09	250	0.09	250	0.09	790	0.28	32	0.01	200	0.07
Dibenzo(a,h)anthracene	260	2.1	0.01	110	0.42	41	0.16	41	0.16	36	0.14	120	0.46	6.6	0.03	36	0.14
Fluoranthene	5100	180	0.04	530	0.10	260	0.05	260	0.05	230	0.05	800	0.16	30	0.01	210	0.04
Fluorene	540	9.6	0.02	19	0.04	26	0.05	17.5	0.03	11	0.02	48	0.09	1	0.00	11	0.02
Naphthalene	2100	32	0.02	105	0.05	55	0.03	95	0.05	47	0.02	105	0.05	5.5	0.00	32	0.02
Phenanthrene	1500	65	0.04	210	0.14	160	0.11	130	0.09	100	0.07	390	0.26	17	0.01	94	0.06
Pyrene	2600	190	0.07	890	0.34	270	0.10	290	0.11	250	0.10	1000	0.38	30	0.01	210	0.08
Total ERM Quotients			**NC**		**6.75**		**3.46**		**3.95**		**3.56**		**7.04**		**0.76**		**2.32**
Mean ERM Quotients			**NC**		**0.27**		**0.14**		**0.16**		**0.14**		**0.28**		**0.03**		**0.09**
Number of ERM Exceedances			**0**		**0**		**1**		**0**		**1**		**1**		**0**		**0**
Category			**NC**		**2**		**2**		**2**		**2**		**2**		**1**		**1**
Input into Triad			**NC**		**+**		**+**		**—**		**+**		**+**		**—**		**—**

Notes:
One-half the detection limit has been used for parameters that were not detected, except for total PCBs and pesticides which used one-tenth the detection limit (See EPA report in Appendix B).
Concentrations exceeding the ERM are shown in **bold**.
NS = not sampled
NC = not calculated because of missing analytes

Table 1-7
Comparison of Mean ERM Quotients – Surface and Subsurface Sediments

EnSafe Station	USEPA Station	Category, (Mean ERM Quotient) and ERM Exceeded for Surface Sediment	Category, (Mean ERM Quotient), and ERM Exceeded for Subsurface Sediment
	DU01	2 (0.19)	NC
IJ-12		Total PCBs	
GH-12	DU02	1 (0.05)	N/A
IJ-34	DU03	1 (0.08)	2 (0.27)
GH-34	DU04	2 (0.14)	2 (0.14)
			Pb
EF-23	DU05	2 (0.42)	2 (0.16)
		Pb, Zn, Total PCBs	
IJ-56	DU06	1 (0.02)	N/A
GH-56	DU07	1 (0.03)	N/A
EF-45	DU08	2 (0.12)	N/A
KL-34	DU09	1 (0.09)	2 (0.14)
			Hg
GH-67	DU10	1 (0.01)	N/A
CD-23	DU11	2 (0.16)	2 (0.28)
			Hg
18	DU18	1 (0.03)	1 (0.03)
22	DU22	2 (0.1)	1 (0.09)

Notes:
Mean ERM Quotients are shown in parenthesis
NC = not calculated.
At Station IJ-56, SVOCs and pesticides/PCBs were not analyzed.

1.2.2 Contaminant Fate and Transport

Site 2 is a complex system with many factors affecting the fate and transport of contaminants introduced to the site. The physical state of the system (saline surface waters, presence of humic substances and clay minerals, and nearby current and past sources for metals) provides a way for contaminants to be introduced into Site 2 media and accumulate. The bay-gulf channel and intercoastal waterway strongly influence the hydraulic movement of sediment into and away from the site.

Below is a list of potential Site 2 sediment contamination sources identified in the final RI Report Addendum (EnSafe, 2004):

- Past activities associated with Buildings 71 (Site 38 [Operable Unit 11]) and 72.
- Past and current boat maintenance and refueling services in the vicinity.
- Past and current surface water runoff.
- Past and current routine application of pesticides draining to the Site 2 area.
- Past and current offsite bay activities (e.g., boat traffic, non-point source sediment drift).

1.3 Remedial Action Objectives

In developing remedial objectives, the following items were reviewed:

- The spatial distribution of sediment contamination, as presented in the Final RI Report Addendum (EnSafe, 2004).

- A BRA, including human health and ecological assessments (E\A&H, 1996).

- Action-, chemical-, and/or location-specific applicable or relevant and appropriate requirements (ARARs).

1.3.1 RI Addendum Assessment

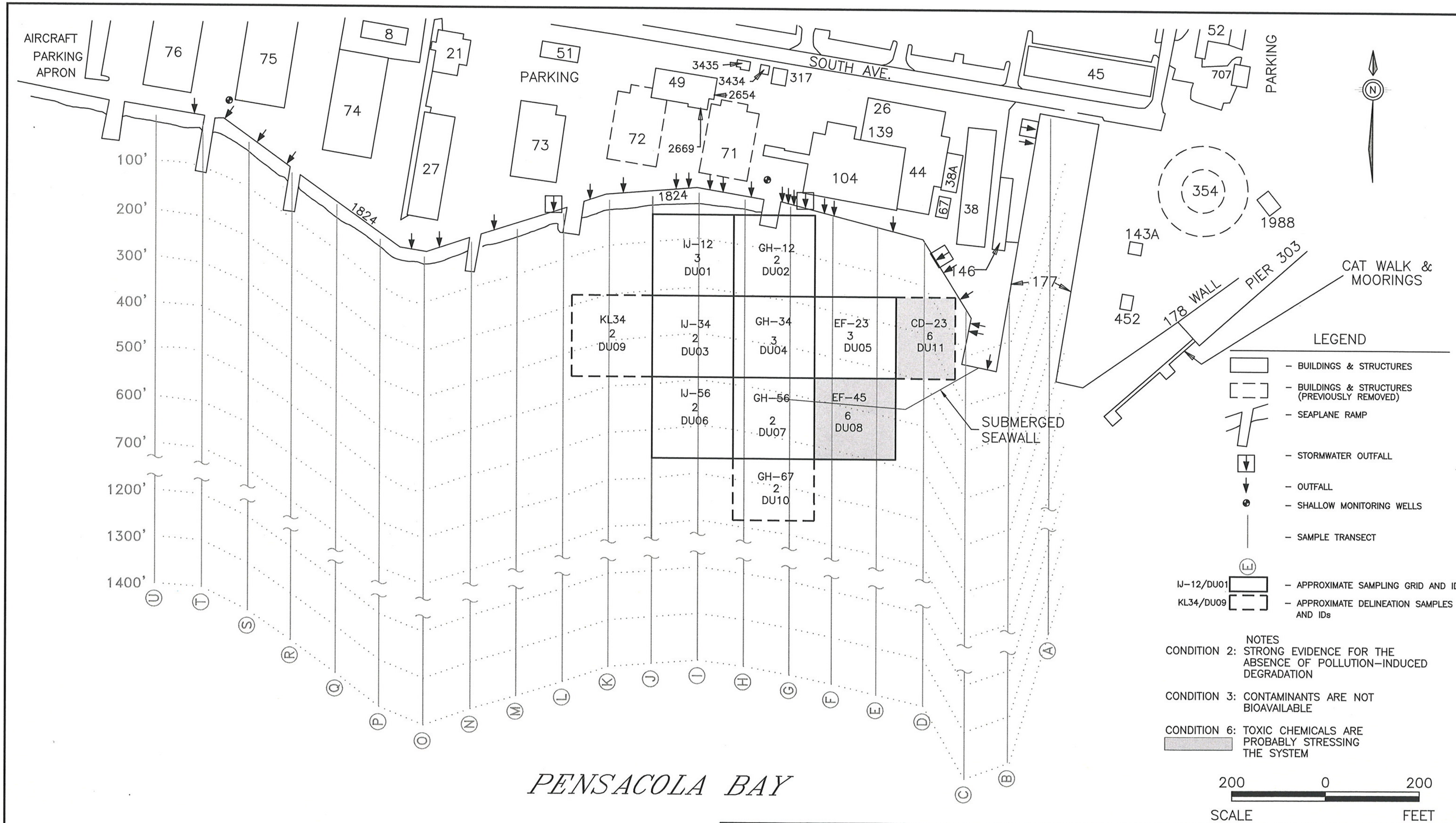
In the Final RI Report Addendum (EnSafe, 2004), sediment contamination (defined as Condition 6) was identified in the southeast portion of Site 2. This distribution moderately correlated with fine-grain sediments and shallow waters in that portion of the site. Based on the 2000 sampling event, DU08 and DU11 sediments were identified as containing toxic chemicals that are probably stressing the ecological system. Figure 1-5 shows the extent of contamination based on the 2000 sampling data and the location of DU08 and DU11. The estimated area extent of contamination is 1,667 square yards.

The groundwater pathway between Site 38 (OU 11), which is north of Site 2, and Site 2 sediments was evaluated as an exposure pathway. From the investigation at Site 38, it was concluded that groundwater and soil had been impacted. According to data in the Site 38 RI, the greatest potential impact to Site 2 is from a volatile organic compound (VOC) plume underneath former Building 71, which is shown in Figure 1-3. However, the model presented in the Site 38 FFS report indicates that the plume has naturally attenuated. Sampling was directed near the shoreline of Site 38 and within the estimated outfall width for offshore groundwater discharge. The VOCs identified in the groundwater at Site 38 were not detected in the sediment and surface water samples collected at Site 2. Based on this data, groundwater discharge from Site 38 is not likely to be a continuous source to Site 2 of contaminants above risk-based action levels in sediment or surface water.

It was recommended in the Final RI Report Addendum that a feasibility study be conducted to determine the most appropriate method for dealing with the sediment at DU08 and DU11.

1.3.2 Baseline Risk Assessment

The BRA was reviewed to identify site COPCs in contaminated media that potentially pose a risk or hazard in current or future-use scenarios. The BRA addressed surface water and sediment media. Both human health and ecological risks were assessed. Potential receptors were identified and adverse effects associated with the site COPCs were qualitatively and quantitatively evaluated.



NAVFAC Naval Facilities Engineering Command SOUTHERN DIVISION

FOCUSED FEASIBILITY STUDY ADDENDUM
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 1-5
EXTENT OF CONTAMINATION BASED ON 2000 SAMPLING DATA

DWG DATE:04/25/05 | NAME: 0059001B015

Ecological Risk Assessment: Marine biota have been or are currently being impacted by sediment contamination in DU08 and DU11 at Site 2 as described in Section 1.2.1. Bioassays completed during the 2000 sampling event indicate toxic chemicals are probably stressing the ecological system at DU08 and DU11, and the feasibility study focuses on theses two locations.

Human Health Risk Assessment: The human health risk and hazard associated with exposure to Site 2 environmental media were assessed for the hypothetical current and future (combined) child and current and future (combined) adult recreationists crabbing exclusively at Site 2. The tissue ingestion exposure pathway was selected as an indicator of potential human health risk. Based on the Site 2 exposure scenarios, no human health levels exceeding acceptable risks were calculated. Subsequent to the completion of the human health risk assessment, Homeland Security Restrictions have been established for the surface water bodies surrounding NAS Pensacola. Unauthorized boat traffic is prohibited within 500 feet of the NAS Pensacola shoreline. Site 2 is within the restricted area.

1.3.3 ARARs and TBCs

There are no chemical- or location-specific ARARs for sediment; however, there are several action-specific ARARs (Appendix A) associated with potential remedial actions. The lead agency (in this case the U.S. Navy), in consultation with the support agencies (in this case the USEPA and FDEP), decides which requirements are applicable or relevant and appropriate. Waivers must be obtained for selected alternatives that do not comply with established ARARs, in accordance with CERCLA 121(d)(4).

1.3.4 Remedial Goals

Based on the analysis presented in the RI Report Addendum (EnSafe, 2004), the following remedial goal options for total polynuclear aromatic hydrocarbons (PAHs) were developed:

- 2,576 µg/kg based on Benthic Community Analysis
- 1,599.8 µg/kg to 2,576.5 µg/kg based on mysid fecunidity
- 2,372 µg/kg based on Leptocheirus survival

Remedial goal options could not be developed based on Leptocheirus growth, mysid survival or mysid growth. The developed RGOs are similar to the USEPA sediment screening value and FDEP sediment quality assessment guideline of 1,684 ppb for Total PAHs. Remedial goals were not developed for other contaminant groups (i.e., metals and pesticides) because a relationship between contaminant concentration and identified effect could not be clearly established.

Based on comparisons to the remedial goal options, locations EF-23 (DU05), CD-23 (DU11) and EF-45 (DU08) exceeded the identified goals. However, toxicity results from EF-23 (DU05) indicate a 97% survival rate for *Leptocheirus*, which is greater than the agreed upon acceptable 80% survival rate and would suggest that a remedial action is not needed for that area. The remaining two stations were previously identified as Condition 6 indicating that unmeasured contamination or conditions exist that may have the potential to cause degradation.

1.3.5 Remedial Objectives and Remedial Volume

The remedial objective is to protect the ecological environment where it is determined that Condition 6 exists, i.e., toxic chemicals are probably stressing the system. Based on the 2000 sediment data, condition 6 exists at DU08 and DU11, which are located in the southeast portion of Site 2. These 150-foot by 150-foot DUs contain 1,667 cubic yards of contaminated sediment, assuming a 1-foot depth for contaminant exposure. Remedial volumes are determined based on toxicity as well as the presence of chemicals of concern.

1.4 Preliminary Technology Screening

The preliminary screening criteria under CERCLA are implementability, effectiveness, and cost. The following remedial process options were considered for Site 2 in light of these criteria, given site sediment conditions and Pensacola Bay characteristics.

- No action
- Dredging and offsite disposal
- Dredging and site-specific confined disposal facilities (CDFs)
- Capping

- Solidification/stabilization
- Long-term sediment monitoring

Implementability: The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and required materials. The readily available information from the RI site characterization and supplemental sampling were used to eliminate technologies and process options. Technical implementability was used to initially eliminate technology types and process options that are clearly ineffective or unworkable. Administrative implementability emphasizes the institutional aspects of implementability, such as the ability to obtain necessary permits for offsite actions; the availability of treatment, storage, and disposal services (including capacity); and the availability of necessary equipment and skilled workers to implement the technology.

Effectiveness: The effectiveness screening evaluation is based on how effective each technology would be in protecting human health and the environment. Each technology is evaluated according to its effectiveness in providing protection and reducing the toxicity, mobility, or volume of contamination. Both short- and long-term components of effectiveness should be evaluated; short-term refers to the construction and implementation period, and long-term refers to the period after the remedial action is complete.

Cost: Costs play a limited role in the preliminary screening process. Relative capital and operation and maintenance (O&M) costs are used rather than detailed estimates. At this stage in the process, the cost analysis is based on engineering judgment, and each process is evaluated as to whether costs are high, low, or medium relative to other alternatives. Table 1-8 presents the six treatment technologies and their objectives, along with preliminary assessments of their implementability, effectiveness, and cost. The table is consistent with technology screening techniques presented in the NCP and USEPA guidance because it includes containment, removal, disposal, and treatment technologies, along with implementability, effectiveness, and cost criteria.

Table 1-8
Technology Screening for Site 2

Technology	Objectives	Implementability	Effectiveness	Cost
No Action	The no-action alternative leaves the sediment in place allowing natural sedimentation to cover and contain pollutants, and/or natural biodegradation to occur.	This option may be appropriate at Site 2 because the pollutant discharge source has been halted and the environmental effects of cleanup may be more damaging than allowing the sediment to remain in place.	Site 2 sediment contamination is expected to biodegrade by natural processes at unknown rates. The contaminated sediments would also likely be isolated by depositional processes, which are shown by the finer grained sediments associated with the sea wall in DU08 and DU11. Survival effects were slightly below the acceptable criteria of 80% at DU08 (73%) and DU11 (78%).	There are minimal costs associated with No Action (costs for the 5-year reviews over 30 years)
Capping	Subaqueous capping consists of placing a sand and gravel cover over the contaminated sediment to isolate it from benthic communities.	This technology is implementable at Site 2; however, some navigational and tidal conflicts may arise. The presence of an underwater wall in and near DU08 and DU11 may pose additional difficulties in implementing this alternative. Suitable capping material is readily available.	This technology eliminates the exposure pathway to the benthic invertebrate community more expeditiously than the no-action alternative. It also eliminates further resuspension of the sediment. Continuing maintenance would be necessary to replace cap material that is eroded by wave action, tidal influences, currents, and/or storms.	High capital cost, potentially high O&M cost.
Dredging and CDFs	CDFs are engineered structures designed to retain dredged material. They can be constructed away from the water, partially in water near shore, or surrounded by water. The primary goal of the CDF design is containment and solids retention.	This technology is implementable at Site 2 onshore only. It would not be practical to construct a CDF in the shallow water near Site 2 or in the bay where navigational conflicts could arise. Dredging would be more difficult given the presence of the underwater wall within/near DU08 and DU11.	CDFs offer an attractive, cost-effective method of dredged material disposal. When properly located and constructed, they can isolate sediment from the environment fairly well.	Low capital cost, low O&M cost.
Dredging and Offsite Disposal	This alternative consists of hydraulically dredging, dewatering, staging, and transporting the sediments to an appropriate offsite disposal facility. Because subsurface sediments are potentially contaminated by legacy contamination, a sand replacement cover would be applied to the dredged areas.	This technology is implementable at Site 2. The location is accessible, and the small volume will be easy to manage. However, this technology adds an additional handling step of transporting the sediment offsite. It is advantageous to avoid multiple handling steps. Again, dredging would be more difficult given the presence of the underwater wall within/near DU08 and DU11.	This technology is effective at containing contaminated media in an approved landfill. Long-term risk to the ecological system and environment onsite is eliminated.	Low to moderate capital cost, no O&M cost.

Table 1-8
Technology Screening for Site 2

Technology	Objectives	Implementability	Effectiveness	Cost
Solidification and Stabilization	In situ solidification/stabilization treatments immobilize sediment and contaminants by treating them with reagents to solidify them. These fixatives neutralize or bind the pollutants to reduce contaminant mobility. Another method covers sediment with barriers or sorbents to reduce transfer of the pollutants to water and biota. This technology satisfies the statutory preference for treatment.	This treatment technology is readily implementable onsite, considering the contaminants present, and could be implemented in situ or ex situ; however, little is known about the large-scale treatments, their effectiveness, or their possible toxic by-products. The presence of the underwater wall poses additional difficulties in implementing this alternative.	Although this technology is effective at rendering sediments and contaminants immobile, several problems are associated with solidification and stabilization. There are inaccuracies in reagent placement, erosion, long-term monitoring requirements, and the inability of the procedure to remove and detoxify contaminants. It is also difficult to adjust solidification mixtures and agents for subaqueous settings when implementing in situ.	Moderate to high capital cost, low O&M cost.
Long-Term Sediment Monitoring (LTSM)	Assess the bioavailability of COPCs and changes in concentrations over time.	LTSM is implementable at Site 2 and may be appropriate due of the low level of risk calculated in the BRA. Source discharges have stopped and there were no human health risks identified for the site. Other alternatives may cause negative short-term impacts to the environment.	Natural burial or decreases in COPC concentrations may occur gradually over time. Use restrictions already in place at Site 2 reduce the potential for human exposure. A long-term monitoring plan would include criteria for deciding whether to proceed with closure, continued monitoring, or another alternative.	Low capital cost, low O&M cost.

Using the implementability, effectiveness, and cost criteria discussed in this table to screen remedial technologies, neither the CDF nor the solidification/stabilization alternatives are practical and/or efficient when compared to the other four proposed technologies. It would not be practical to construct a CDF onshore and continually have to maintain it, or to construct it in shallow water where the current and tidal fluctuations could cause erosion. The solidification/stabilization technology is difficult to implement in situ for sediment, but can be implemented ex situ. However, ex situ solidification/stabilization requires a treatability study to determine appropriate materials, equipment, and mixing ratios and requires multiple material handling stages, which would increase the cost. Given the low volume (1,667 cubic yards) of sediment and the relative ease of implementation for the other alternatives, CDFs and ex situ solidification/stabilization were not retained for further evaluation.

1.5 Focused Feasibility Study Addendum Alternatives

As described in the NCP, the primary objective of the FFSA is to ensure that appropriate remedial alternatives are developed and evaluated so that relevant information concerning these options can be presented to decision-makers, and the appropriate remedy selected. To accomplish this objective, the feasibility study is tasked with addressing only remedial measures appropriate to the scope and complexity of the project.

There are fewer remedial options available for sediment contamination than for other media (i.e., soil, groundwater, and air). Consequently, the available technologies for remediating sediment are very similar. Because the remediation objectives for this site are clearly defined and sediment volumes are small, the FFSA format will be used to address the medium of concern. The following four remedial alternatives will be evaluated:

- **Alternative 1 — No Action:** Consideration of this alternative is required under the NCP. Under the no-action alternative, sediment would be left in place. This alternative poses no risk to current workers and site trespassers, and no additional risk to the ecosystem.

- **Alternative 2 — Capping:** Subtidal capping involves placement of a clean sand layer to isolate contaminants and limit their vertical migration and release into the water column. In addition to limiting migration, a cap would also limit the potential for marine organisms to reach the site sediment. Capping would cause an immediate acute adverse impact to the benthic organisms in that area but would ultimately eliminate exposure to contaminants that may be causing adverse effects.

- **Alternative 3 — Dredging and Offsite Disposal:** The two DUs identified in Figure 1-5, DU08 and DU11, can be dredged to remove the surface sediment from the site, eliminating future adverse effects to the ecological system. Because subsurface sediments are potentially contaminated with legacy contamination, the dredged areas would be covered with a sand replacement cover. The dredged sediment would be disposed offsite, presumably in an approved Subtitle D facility. Although this alternative would result in an immediate acute adverse impact to the benthic organisms, it would ultimately limit the long-term effects to the ecological system in these areas.

- **Alternative 4 — Long-Term Sediment Monitoring:** Under this alternative, site sediments would remain in place, controls would be implemented to limit access to the site, and the site would be monitored once every 5 years for changes that may affect risk. This alternative poses no risk to human health and relies on the continued prohibition of waste disposal at this site and natural processes within the bay to mitigate risk to benthic organisms.

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section describes the initial steps toward remedy selection: identification of remedial objectives, general response actions, applicable technologies, and regulatory constraints under which remediation is conducted.

2.1 Alternative 1: No Action

Under this alternative, no-response action for site sediment would be conducted to contain, remove, or treat sediment contamination that exceeds risk- or leachability-based cleanup goals. Sediment would remain in place to attenuate according to natural biotic or abiotic processes.

2.1.1 Alternative 1 — Remedial Elements

There are no remedial elements associated with the no-action alternative.

2.1.2 Alternative 1 — Implementability

This alternative is technically and administratively feasible. No initial actions are required; therefore, this alternative is readily implementable. The NCP requires any alternative that leaves contamination onsite to be reevaluated every 5 years to ensure adequacy of the alternative (40 CFR §300.430[f][4][ii]). Therefore, the no-action alternative would require the Navy to establish a program for these reevaluations.

2.1.3 Alternative 1 — Effectiveness

The no-action alternative does not provide any additional effectiveness over the current use scenario. This alternative does not reduce the toxicity, mobility, or volume of the contaminants; however, current site access controls prohibit swimming and homeland security restrictions prohibit boat traffic, reducing the potential for direct human contact with site sediments. Under the no-action alternative, the only risks are to the resident marine organisms.

2.1.4 Alternative 1 — Cost

As shown in Table 2-1, the 30-year present value cost for the no-action alternative consists of the 5-year evaluation cost over a 30-year period. The cost for this review is estimated at $10,000 per event for the no-action alternative for sediment. The present value of reevaluation every 5 years for 30 years is approximately $24,400, assuming a 6% discount factor. The total cost for Alternative 1 is $45,000. Supporting detailed costs and assumptions for each alternative are provided in Appendix B.

Table 2-1
Estimated Costs Associated with the No-Action Alternative

Action	Cost
Initial Evaluation Costs	$10,000
Subsequent Evaluation Costs[a]	$24,400
Subtotal Present Value Monitoring Costs	*$34,400*
Contingency (10%)	$3,400
Contractor Reporting Requirements (10%)	$3,400
Overhead and Profit (10%)	$3,400
Total Cost (rounded to nearest $1,000)	**$45,000[b]**

Notes:
[a] = Frequency is every 5 years.
[b] = Based on a 6% discount rate over 30 years.

2.2 Alternative 2: Capping

A subaqueous cap would consist of a 24-inch-thick (U.S. Army Corps of Engineers [USACE], 1988) coarse sand and gravel layer to prevent benthic organisms from contacting contaminated material and to hold site sediment in place. To protect the cap from erosion, adequate controls would need to be constructed (e.g., rip-rap facing, breakwaters, etc.).

2.2.1 Alternative 2 — Remedial Elements

A remedial design investigation would be needed to further delineate the area of concern, determine actual current velocities and directions, and study wave action at the site to evaluate potential erosion controls.

Remedial action would consist of placing 24 inches of material over the site sediments and placing appropriate erosion controls, e.g., rip-rap facing along the cap perimeter. The cap would then require annual monitoring to ensure its integrity. If the cap showed excessive erosion, lost material would need to be replaced with new backfill. Controls would be needed to prevent future dredging near the cap, and markers would be needed for boating safety due to loss of navigational depths.

2.2.2 Alternative 2 — Implementability

This alternative is administratively and technically feasible. Potential implementation concerns include temporary loss of shoreline use to the Navy and dredging activity restrictions associated with the nearby navigational channel operations. A remedial design investigation and associated engineering plans and specifications would need to be developed.

2.2.3 Alternative 2 — Effectiveness

Based on USACE studies on capping of contaminated dredged material, this alternative would adequately protect the Site 2 ecology. Changing the bottom type from fine grained sediment to coarse sand would change the benthic community structure. Although capping would temporarily eliminate any resident benthic organisms, they would be expected to recolonize the area over time. Several studies would be needed during remedial design to ensure cap effectiveness. Current and velocity mapping would be needed to evaluate sediment transport and potential erosion rates. Burrowing depths for bay biota should also be assessed to design an adequate cap thickness.

The main concern regarding the cap's effectiveness would be storm-induced erosion. Hurricanes and other strong storms occur annually in and around Pensacola. Forces induced by these storms are difficult to predict and could destroy a conservatively designed cap. However, the presence of unconsolidated, fine-grained sediments indicates a general lack of high water velocities and favor the durability of a coarse-grained cap.

For cost estimation purposes, a potential cap design was evaluated for erosion potential using RI estimates of channel velocities ranging from 5 to 13.4 feet per second (ft/s). Channel velocity distribution is based on shoreline features, irregularity of the channel bottom, and depth of flow. It is reasonable to assume half the average velocity is acting on bed sediments. Consequently, the estimated bed velocities for the channel range from 1.5 to 4 knots (2.5 to 6.7 ft/s). For channel design, several tables describe permissible water velocities for specific channel-lining materials. Permissible water velocities are the maximum at which the channel lining material will remain in place. Coarse gravel has a permissible velocity of 6 ft/s (North Carolina Sedimentation Control Commission, 1988), which is inadequate for the upper end of the assumed velocities. However, given the presence of fine-grained sediments at Site 2, the RI velocity estimates are too high, the bed velocities are less than half of the average estimated velocity, or cohesive forces are preventing erosion of bottom sediments.

2.2.4 Alternative 2 — Cost

Table 2-2 presents the cost estimate for the capping alternative. Supporting detailed costs and assumptions for each alternative are provided in Appendix B.

Table 2-2
Estimated Costs Associated with the Capping Alternative

Action	Total Cost
Construction Costs	$765,200
Monitoring Costs	$208,200
Refurbishment Costs	$249,000[a]
Subtotal Present Value Direct Costs	*$1,222,400*
Contingency (30%)	$366,700
Contractor Reporting Requirements (10%)	$122,200
Overhead and Profit (10%)	$122,200
Total Cost (rounded to nearest $1,000)	**$1,834,000[b]**

Notes:
[a] = Assumes 25% of cap is reconstructed every 10 years.
[b] = Based on a 6% discount rate over 30 years.

2.3 Alternative 3: Dredging and Offsite Disposal

This alternative consists of hydraulically dredging sediment from DU08 and DU11. Dredged sediments would be dewatered, staged, sampled, and classified. Nonhazardous soil would be disposed offsite in a Class I landfill, whereas hazardous soil would be disposed offsite in RCRA Subtitle D landfill. Although some hazardous soil may require pretreatment prior to disposal, soil treatment is not considered in this cost estimate. Nonhazardous dredge spoils are presumed unsuitable for onsite use because several COPCs exceed FDEP's residential and commercial/industry soil cleanup target levels. The dredged areas would be covered with 1 foot of sand replacement fill, which would cover potentially contaminated subsurface sediments. The dredging of surficial sediment would reduce their associated ecological risks. Although the exposure of deeper sediments may introduce additional ecological risks, these would be mitigated by the placement of a replacement sand cover.

Although nonhazardous dredge spoils that do not exceed FDEP residential soil cleanup target levels may be used as onsite fill material, this potential cost savings option is not considered in this alternative. The composite surface sediment samples from DU08 and DU11 exceed several FDEP residential soil target cleanup levels; specifically arsenic, vanadium, and benzo(a)pyrene in DU08 and arsenic, vanadium, benzo(a)pyrene, and dibenzo(a,h)anthracene in DU11. Although the only FDEP commercial/industrial soil cleanup target level exceedance in DU08 and DU11 was arsenic, FDEP guidance explicitly states that residential soil cleanup target levels should be used to determine whether remediation waste is hazardous via the contained-in rule ("Management of Contaminated Media under RCRA" memorandum, August 21, 2002). Additionally, land disposal restrictions were not exceeded for non-metal COPCs in the DU08 and DU11 surface sediment composite samples. Because leachability tests were not performed, land disposal restrictions for metal COPCs are inconclusive. Assuming a maximum leachability (i.e., leached concentration is 20 times soil concentration), lead equals 10 x Universal Treatment Standards (UTS) in DU11 and no metals exceed land disposal restrictions (LDRs) in DU08. The viability using dredged material as onsite fill material would need to be further evaluated and may be contingent on post-dredging sample results.

2.3.1 Alternative 3 — Remedial Elements

Before dredging could occur, a permit must be obtained from the USACE. Waste treatability studies would also be conducted prior to project mobilization to:

- Simulate, on a bench scale and in a controlled environment, actual operating conditions (e.g., sediment compressibility) and operating parameters using representative in situ waste stream samples.

- Assess the approximate percent of contaminated material.

- Determine filter press operating requirements (e.g., need for polymer or lime additives).

- Determine actual processing parameters.

The contaminated sediments in DU08 and DU11 would be hydraulically dredged by divers. A dive crew can dredge to a depth of 1 foot more precisely and with less water column disruption than alternative dredging methods. The sediments would be pumped directly to a filter press to dewater them. Hydraulic dredging typically generates 90% water and 10% solids. The separated water would be pre-treated with activated carbon and either discharged to the Navy-owned wastewater treatment works or a National Pollutant Discharge Elimination System (NPDES) permit would be obtained to discharge the activated carbon treated water to the bay. The dewatered solids would be staged, sampled, and classified. Nonhazardous soil would be disposed in a Class I landfill, whereas hazardous waste would be disposed at a RCRA Subtitle D landfill. If hazardous soils exceed 10 x UTS as defined in 40 Code of Federal Register (CFR) §268.48, the soils may require pretreatment prior to disposal. Although soil washing may be an appropriate means of pretreatment, soil treatment is not considered in this alternative.

The dredging and offsite disposal alternative also includes the placement of offsite sand as a replacement cover. Replacement cover is needed because deeper sediments (>1 ft) may also exceed ecological risks because of the burial of legacy contamination. For example, in the deep sediment sample collected from DU11, the effects-based hazard quotient exceeded 1 for several PAHs, pesticides, and metals. In DU08, a deep sediment sample was not collected because of core sampler refusal.

2.3.2 Alternative 3 — Implementability

This alternative is both technically and administratively feasible at Site 2. Pensacola Bay and the boat slip near Pier 303 are now dredged on an as-needed basis. Dredging is a reliable option for removing site sediment. Dredged areas include about 45,000 square feet. Assuming a depth of 1 foot, sediment volumes would be about 1,667 cubic yards. Dredging is estimated to require fourteen 12-hour days to remove 1 foot of sediment from DU08 and DU11.

One disadvantage of dredging is the potential for the resuspension of site sediments and the mobilization of otherwise bound contaminants. This resuspension and release could have an immediate negative impact in the water column. The redistribution of dredged material is minimized by utilizing a dive crew to dredge the site sediment.

Dredging is administratively feasible. Permits would be required before any dredging operations could take place; however, because the bay and boat slip are currently being dredged, it is expected permits to dredge Site 2 could be readily obtained.

2.3.3 Alternative 3 — Effectiveness

Dredging is effective at limiting chronic impacts to the ecology, but immediate protection would not be provided. In the short-term, benthic organisms would be severely stressed by hydraulic dredging. Benthic organisms would be expected to recolonize the recovered, dredged areas after the construction activities are completed.

2.3.4 Alternative 3 — Cost

Table 2-3 shows capital costs associated with the dredging alternative based on an excavation depth of 1 foot. Supporting detailed costs and assumptions for each alternative are provided in Appendix B.

Table 2-3
Estimated Costs Associated with the Dredging and Offsite Disposal Alternative

Action	Total Cost
Dredging, Dewatering, and Staging Costs	$328,300
Replacement Cover Costs	$316,000
Disposal Costs	$133,100
Engineering and Design Costs	$77,700
Subtotal Present Value Direct Costs	*$855,000*
Contingency (30%)	$256,500
Contractor Reporting Requirements (10%)	$85,500
Overhead and Profit (10%)	$85,500
Total Cost (rounded to nearest $1,000)	**$1,283,000**

2.4 Alternative 4: Long-Term Sediment Monitoring

In the LTSM alternative, site sediments would be left in place, controls would be implemented to limit site access, and the site would be monitored every 5 years. This alternative poses no risk to human health and relies on the continued prohibition of waste disposal at this site and natural processes within the bay to prevent increased risk to benthic organisms.

The level of monitoring with this alternative is significantly greater than that of the no-action alternative. LTSM includes the development and implementation of a detailed monitoring plan. In addition to detailed sampling and analysis procedures, the LTSM plan would outline remedial goals in terms of ecological risk and conditions warranting the consideration of another remedial alternative, further monitoring, or remedial closure.

2.4.1 Alternative 4 — Remedial Elements

A regular schedule of site monitoring would be implemented to evaluate the effectiveness of natural processes that reduce the level of risk to the environment. Each monitoring event would include the following:

- Sediment sampling and analysis for metals, semivolatile organic compounds (SVOCs), pesticides, and PCBs to evaluate changes in concentrations.

- Ten-day *Leptocheirus plumulosus* and 7-day *Mysidopsis bahia* sediment bioassays to evaluate changes in sediment toxicity.

- A hydrographic survey to assess changes in benthic topography and to evaluate the potential for further migration of site sediments.

- Measurement of sediment accumulation above feldspar marker horizons placed during the initial monitoring event to assess the rate of natural sedimentation.

The initial monitoring event would also include the following:

- Cesium dating and COPC analyses of sediment cores to assess the historic rates of sedimentation and the depositional ages of the highest concentrations of selected metals.

- Measurement of redox potential and pH in the field, and laboratory testing of grain size, clay content, total organic carbon, acid volatile sulfides, simultaneously extracted metals, and metals partitioning to assess the in situ bioavailability of COPCs.

Access controls are currently in place at Site 2. Homeland security restrictions prevent boat traffic within 500 feet of the shoreline. Violators of the restrictions are taken into custody by the Coast Guard or by a U.S. Marshall. Access from shore to the site sediments at Site 2 is controlled by the U.S. Navy. The shoreline is dominated by a 3- to 4-foot-high concrete seawall. Fishing in the Site 2 area would be limited.

2.4.2 Alternative 4 — Implementability

This alternative is technically and administratively feasible. No construction, operation, or maintenance is required. The original Site 38 outfalls have not been used for at least 18 years, and no other outside point-source of contamination was identified during the RI.

2.4.3 Alternative 4 — Effectiveness

This alternative has no short-term effectiveness, and only long-term monitoring results will indicate long-term effectiveness. There are many factors that support this option's potential for long-term effectiveness:

- Natural sedimentation could be occurring in the area of concern and could eventually bury the contaminated material.

- Organisms at Site 2 could transform or degrade organic COPCs to less toxic forms via bioprocesses. Intrinsic bioremediation, even of these persistent (organic) compounds, occurs naturally but slowly in sediments, and uses indigenous microorganisms and enzymatic pathways of both aerobic and anaerobic processes. As natural sedimentation and/or transformation of the chemicals occur, other less opportunistic species in the bay may begin to move into the area naturally (Bishop, 1996).

- Additional testing may refine risk assessment capabilities and show a reduced level of risk, which does not require further remedial action.

Other advantages of LTSM include no disturbance of the sediments and continued protection of the water column from groundwater infiltration. Not disturbing the sediments eliminates the risk of releasing sediment-bound contaminants into the water column. The existing sediments could also be preventing contaminants in infiltrating groundwater from entering into the surface water column. Heavily reduced sediments are typically capable of removing inorganic and organic compounds through binding and reductive processes.

2.4.4 Alternative 4 — Cost

Table 2-4 presents the costs associated with LTSM or natural attenuation. Supporting detailed costs and assumptions for each alternative are provided in Appendix B.

Table 2-4
Estimated Costs Associated with the LTSM Alternative

Action	Total Cost

Table 2-4
Estimated Costs Associated with the LTSM Alternative

Action	**Total Cost**
Initial Monitoring Costs	$64,000
Subsequent Monitoring Costs [a]	$78,100
Subtotal Present Value Direct Costs	*$142,100*
Contingency (30%)	$42,600
Contractor Reporting Requirements (20%)	$28,400
Overhead and Profit (10%)	$14,200
Total Cost (rounded to nearest $1,000)	**$227,000**[b]

Notes:
[a] = Frequency is every 5 years.
[b] = Based on a 6% discount rate over 30 years.

3.0 DETAILED ANALYSIS OF ALTERNATIVES

In this section, the remedial alternatives discussed in Section 2 are examined with respect to requirements stipulated in CERCLA as amended, the NCP, OSWER Directive No. 9355.9-19 (*Interim Guidance on Superfund Selection of Remedy,* December 24, 1986), and factors described in *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988).

3.1 Evaluation Process

The detailed analysis of alternatives consists of analyzing and presenting the relevant information needed to allow decision-makers to select a site remedy, but it does not replace the decision-making process. During the detailed analysis, each alternative is assessed against the evaluation criteria and all other alternatives. The results of the assessment are arrayed to compare the alternatives and identify the key tradeoffs among them. This approach to analyzing alternatives is designed to provide decision-makers sufficient information to adequately compare the alternatives, select an appropriate remedy for the site, and demonstrate satisfaction of CERCLA remedy-selection requirements.

Per 40 CFR §300.430(e)(9)(iii), nine evaluation criteria were evaluated to address the CERCLA requirements and considerations, and to address the additional technical and policy considerations that have proven important for selecting among remedial alternatives. These evaluation criteria serve as the basis for conducting the detailed analyses during the FFSA and for subsequently selecting an appropriate remedial action. The evaluation criteria with the associated statutory considerations are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness

- Implementability
- Cost
- State acceptance
- Community acceptance

Each remedial alternative is evaluated with respect to the above criteria, as described in the following sections. In Section 4, the statutory factors and nine criteria listed above are compared for each alternative to assist in the remedy selection process.

3.1.1 Overall Protection of Human Health and the Environment

This criterion establishes whether the alternative adequately protects human health and the environment, in both the short- and long-term, from unacceptable risks by eliminating, reducing, or controlling exposures to the contaminated sediment. The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

3.1.2 Compliance with ARARs

This criterion is used to evaluate whether each alternative will meet all federal and state ARARs identified in previous stages of the remedial process. The detailed analysis identifies which requirements are applicable or relevant and appropriate to an alternative, and should include compliance with action-, chemical-, and location-specific ARARs.

The actual determination of which requirements are applicable or relevant and appropriate is made by the lead agency (the Navy) in consultation with the USEPA and FDEP.

3.1.3 Long-Term Effectiveness and Permanence

Evaluation of alternatives under this criterion addresses the results of a remedial action in terms of the risk remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The following components should be addressed for each alternative:

- **Magnitude of Residual Risk:** This factor assesses the residual risk from untreated waste or treatment residuals at the conclusion of remedial activities. This risk may be measured by numerical standards such as cancer risk levels or the volume or concentration of constituents in waste, media, or treatment residuals remaining onsite.

- **Adequacy and Reliability of Controls:** This factor assesses the adequacy and suitability of any controls used to manage treatment residuals or untreated wastes remaining onsite. It may include an assessment of containment systems and institutional controls to determine whether they are sufficient to ensure that exposure to human and environmental receptors is within protective levels.

3.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This evaluation criterion addresses the statutory preference for remedial actions employing treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances.

The evaluation should consider the following specifics:

- The treatment processes, the remedies they will employ, and the materials they will treat.

- The quantity of hazardous materials that will be destroyed or treated, including how principal threat(s) will be addressed.

- The degree of expected reduction in toxicity, mobility, or volume, measured as a percentage of reduction (or order of magnitude) whenever possible.

- The degree to which the treatment will be irreversible.

- The type and quantity of treatment residuals that will remain.

- Whether the alternative would satisfy the statutory preference for treatment as a principal element.

3.1.5 Short-Term Effectiveness

The short-term effectiveness of a remedial alternative is evaluated relative to its effect on human health and the environment during implementation. Short-term effectiveness is based on four key factors:

- Risks to the community during implementation of the remedial action;
- Risks to workers during implementation of the remedial action;
- Potential for adverse environmental impact as a result of implementation; and
- Time until remedial response objectives are achieved.

3.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required for implementation. The following factors will be evaluated:

Technical Feasibility

- Construction and operation relating to the technical difficulties and unknowns.

- Reliability of technology, focusing on the likelihood of technical problems causing schedule delays.

- Ease of undertaking remedial action, discussing future remedial actions that may be required and the difficulty of implementing them.

- Monitoring considerations such as the ability to monitor the remedy's effectiveness, including an evaluation of exposure risks should monitoring be insufficient to detect a system failure.

Administrative Feasibility

- Activities needed to coordinate with other offices and agencies.

Availability of Services and Materials

- Availability of adequate offsite treatment, storage capacity, and disposal services.

- Availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources.

- Availability of services and materials, including the potential to obtain competitive bids, which may be particularly important for innovative technologies.

- Availability of prospective technologies.

3.1.7 Cost

Detailed cost estimates for each remedial alternative are based on engineering analyses, suppliers' estimates of necessary technology, and costs for similar actions (such as excavation) at other CERCLA and Resource Conservation and Recovery Act (RCRA) sites. Costs are expressed in 2003/2004 dollars. The cost estimate for a remedial alternative consists of four principal elements: capital cost, operation and maintenance cost, costs for five-year evaluation reports, and present value analysis.

Capital Costs

- ***Direct costs*** for equipment, labor, and materials used to develop, construct, and implement a remedial action.

- ***Indirect costs*** for engineering, financial, and other services that are not actually part of construction, but are required to implement a remedial alternative. The percentage applied to the direct cost varies with the degree of difficulty associated with construction and/or implementation of the alternative. In this FFSA, the indirect costs include health and safety items, permitting and legal fees, bid and scope contingencies, and engineering design and services.

Annual O&M Costs

O&M costs refer to post-construction costs necessary to ensure the continued effectiveness of a remedial action. They typically refer to long-term power and material costs (such as the operational cost of a water treatment facility), equipment replacement costs, and long-term monitoring costs.

Costs for Five-Year Evaluation Reports

These costs are for reports prepared every five years evaluating the results of monitoring activities.

Present Value Analysis

This analysis allows comparison of remedial alternatives based on a single cost that, if invested in the base year and disbursed as needed, would be sufficient to cover remedial action costs during its planned life. A 30-year performance period is assumed for present value analyses. Discount rates of 6% are assumed for base calculations. An increase in the discount rate decreases the present value of the alternative.

The cost elements of each alternative are summarized in the cost analysis section. Cost estimates are intended to reflect actual costs with an accuracy of minus 30% to plus 50%, in accordance with USEPA guidelines.

3.1.8 State Acceptance

This step evaluates the technical and administrative issues and concerns the state may have regarding each alternative. This criterion is largely satisfied through state involvement in the entire remedial process, including review of the FFSA.

3.1.9 Community Acceptance

This step evaluates the issues and concerns the public may have regarding each alternative. This criterion would be established after the public comment period for the FFSA.

3.2 Evaluation of Selected Alternatives

The following sections present a detailed analysis of each alternative in Section 2.

3.2.1 No Action

The no action alternative for Site 2 would involve no active remedial effort. No actions would be taken to contain, remove, or treat sediment contaminated above risk-based cleanup goals. Sediment would remain in place and would attenuate according to natural biotic or physical processes. Although there is insufficient data to estimate natural attenuation rates, the AVS/SEM analyses indicate that metals are not bioavailable in DU08, but are bioavailable in DU11.

Overall Protection of Human Health and the Environment

The no action alternative affords no long-term effectiveness and permanence beyond natural processes. No short-term impacts are associated with this alternative. As stated in the BRA, however, no human health risks were identified for the Site 2 sediment. The physical controls presently in place at Site 2 adequately restrict human contact with site sediment.

Homeland security restrictions prevent unauthorized boat traffic within 500 feet of the NAS Pensacola shoreline. These controls are considered reliable for protecting human health, given current projected site use.

Compliance with ARARs

The no action alternative complies with all ARARs and does not trigger any location- or action-specific ARARs.

Long-Term Effectiveness and Permanence

The long-term effectiveness criterion evaluates the results of a remedial action relative to the remaining onsite risk, particularly any residual risk and the adequacy and reliability of controls. Current contaminant levels at Site 2 would attenuate slowly, decreasing the volume and concentrations of site sediment. Over time, adverse effects to benthic organisms would diminish.

Reduction of Toxicity, Mobility, or Volume through Treatment

The no action alternative does not reduce the mobility or volume of contaminants. Contaminants would remain onsite; however, natural processes (either biological, physical, and/or chemical degradation and/or burial) would continue and could decrease the risk to benthic organisms.

Short-Term Effectiveness

Short-term effectiveness assesses the effects of an alternative on human health and the environment while implementing the remedial alternative. There are no implementation concerns associated with the no action alternative. This alternative may be implemented immediately.

Implementability

The no action alternative is technically feasible and easily implemented. No construction, operation, or reliability issues are associated with this alternative. Current site controls have proven reliable in the past. No administrative coordination is required to implement the no action alternative. The no action alternative would not require offsite services, materials, specialists, or innovative technologies.

Cost

The no action alternative cost is detailed in Section 2.1.4. The no action alternative cost includes a $10,000 initial engineering and design study and subsequent $10,000 5-year review costs. The estimated 30-year present value for the no action alternative is $45,000, assuming a 6% discount rate and including a 10% contingency.

State Acceptance

The Navy has involved FDEP and USEPA throughout the entire remedial process. FDEP will have the opportunity to review and comment on this FFSA.

Community Acceptance

The status of community acceptance for the no action alternative will be established after the public comment period for the FFSA.

3.2.2 Capping

Capping would involve constructing a physical barrier between site sediments and the biota in Pensacola Bay. Sediment would remain in place and be covered with a layer of coarse-grained sand and gravel. In areas where waves may cause excessive erosion, rip-rap or other suitable material would be placed to stabilize it.

Overall Protection of Human Health and the Environment

According to the BRA, no human health risks were identified for the Site 2 sediment. Capping would likely exterminate benthic organisms in the application area, but would effectively protect the environment, including bottom-dwelling life, after construction is completed. Over time, benthic organisms would re-colonize the area.

Compliance with ARARs

According to the Clean Water Act, a permit must be obtained before dredged or fill material is discharged into navigable waters. In addition, State of Florida (FR 62-312) and federal (33 CFR §320 and §322) regulations outline dredging and filling requirements applicable to this action.

Long-Term Effectiveness and Permanence

The effectiveness of this design would be determined by its ability to prevent biota from migrating through the cap and contacting site sediment, and whether site sediments are held in place. If these two properties are maintained, risk to human health and the environment would not be expected.

Consolidation of the cap would be expected to be minimal because of the high sand content of the sediment and the coarse grain-size material specified for the cap. The cap may be eroded by wave action, high-velocity currents, propeller wash, and other physical wear. Although sufficient controls could be designed to prevent catastrophic erosion, the presence of fine-grained sediments at Site 2 indicates that this area is in a relatively low energy zone. The cap would be periodically inspected by collecting core samples and performing a hydrographic survey. In the event that sufficient erosion is detected, the emplacement of additional capping material may be required.

Reduction of Toxicity, Mobility, or Volume through Treatment

Capping is a containment action that restricts the movement of underlying site sediments. The cap would be thick enough to prevent site sediment contact with burrowing benthic organisms.

Capping would not remove, treat, remediate, or reduce the amount of site sediments; however, capping would further reduce the oxidation state of site sediments, thereby further immobilizing some metal contaminants.

Short-Term Effectiveness

In the short-term, implementing this alternative would eliminate all marine life within the immediate area of Site 2. Upon completion of construction, there would be no expected risk to species re-colonizing the area.

Implementability

This alternative is technically and administratively feasible. Capping would require a remedial design phase, remedial action, O&M, and site monitoring. Remedial design would consist of further site investigation, report preparation, design drawings, specifications, an O&M plan, and a 30-year monitoring plan. Remedial action would consist of all activities necessary to construct the cap. O&M and monitoring plans would need to be implemented. Site access controls would be necessary to restrict navigational dredging, and a warning system (e.g., buoys) would be needed to identify the new shallow water depth.

Cost

The capping cost is detailed in Section 2.2.4. The estimated construction and monitoring costs are $765,200 and $208,200, respectively. The estimated refurbishment cost is $249,000, based on a 25% material loss and replacement every 10 years. The estimated 30-year present value for the capping alternative is $1,834,000, assuming a 6% discount rate and including a 30% contingency.

State Acceptance

The Navy has involved FDEP and USEPA throughout the entire remedial process at Site 2. FDEP will have the opportunity to comment on this FFSA.

Community Acceptance

The status of community acceptance for the capping alternative will be established after the public comment period for the FFSA.

3.2.3 Dredging with Offsite Disposal

This action includes dredging, backfilling, dewatering, staging, sampling, classification, and offsite disposal of contaminated sediment. Exccedances of FDEP's residential soil cleanup target levels were identified in both DUs, therefore use of nonhazardous dredge spoils as onsite fill material was not considered in this alternative.

Overall Protection of Human Health and the Environment

Hydraulic dredging and subsequent backfilling addresses the long-term effectiveness and permanence criterion by removing sediment from the site. Although dredging may expose additional ecological risks from potentially contaminated underlying sediments, these sediments would be covered with a 12-inch sand replacement cover. Short-term risks posed during implementation include elimination of benthic organisms in the application area and human health risks from inhalation and dermal contact exposures. Benthic organisms would re-colonize the area, however, and human health risks can be controlled with common engineering techniques and personal protective equipment.

Compliance with ARARs

According to the Clean Water Act, a permit must be obtained before dredged or fill material is discharged into navigable waters. In addition, State of Florida (FR 62-312) and federal (33 CFR §320 and §322) regulations outline dredging and filling requirements applicable to this action. Water discharge from the filter press would require an NPDES permit for discharge to surface waters; whereas waters discharged to the Navy-owned waste water treatment works would be required to meet pretreatment standards. Staged soils may also require an NPDES storm water permit. Offsite transportation would trigger Department of Transportation regulations. Depending of waste classification, disposed soils would be required to satisfy LDRs for hazardous soils and FDEP disposal requirements for nonhazardous soils.

Long-Term Effectiveness and Permanence

Dredging eliminates long-term risk posed by the site sediments to benthic organisms, the overall ecology, and human health and the environment; however, future liability would be incurred by the Navy through disposal at a landfill. Although dredging may expose additional ecological risks from potentially contaminated underlying sediments, these sediments would be covered with a 12-inch sand replacement cover.

Reduction of Toxicity, Mobility, or Volume through Treatment

Dredging with backfilling does not meet the statutory preference for reducing toxicity, mobility, or volume through treatment. If dredged soils are classified as hazardous, land disposal restrictions would be invoked, which may necessitate pretreatment prior to disposal. Treatment of dewatered, dredged sediment is not anticipated or considered in this alternative, however.

Short-Term Effectiveness

Dredging Site 2 with the small hydraulic dredges recommended in this study would have no impact on the community. The dredging operation would be sufficiently removed from the public to minimize health and safety concerns associated with sediment removal. The dive team would have to take appropriate protective measures to prevent direct contact with the site sediment, particularly during maintenance of dredging equipment. The filter press would be located onshore and would require restrictions to prevent access by the public.

In the short-term, dredging would exterminate benthic organisms in the area of application. Upon completion of construction, no risk would be expected to species re-colonizing the area.

Implementability

Dredging with offsite disposal is implementable. The Site 2 boat slip and nearby intra-coastal waterway navigational channel are dredged periodically.

Dredging is a common remediation technique for sediments. Potential technical problems that could slow removal activities include sediment preconditioning to facilitate filter press operations, management of removed sediment and drained water, and materials handling and disposal (standby time between confirmatory sampling and disposal). Administrative coordination would involve acquiring a permit from the USACE before dredging could begin. Coordination with the Navy-owned waste water treatment works may be necessary if the wastewater from the filter press requires treatment before being discharged. Independent contractors capable of performing dredging operations for this alternative are located in the area.

Cost

The dredging and offsite disposal cost is detailed in Section 2.3.4. Based on a one-foot depth of removal and backfill, the estimated direct construction and disposal cost is $855,000. Dredged soils would be dewatered by filter press and presumably disposed as non-hazardous waste at a RCRA Subtitle D landfill. Excluding transportation, compliance sampling, and exempted taxes, the estimated direct cost for disposal is $98,800. No long-term O&M costs are associated with this alternative. The estimated cost for the capping and offsite disposal alternative is $1,283,000, which includes a 30% contingency.

State Acceptance

The Navy has involved FDEP and USEPA throughout the entire remedial process at Site 2. FDEP will have the opportunity to comment on this FFSA.

Community Acceptance

The status of community acceptance for the dredging and offsite disposal alternative will be established after the public comment period for the FFSA.

3.2.4 Long-Term Sediment Monitoring

LTSM differs from no action. Under this alternative, site sediments would be left in place, site access controls would continue, and the site would be monitored for a variety of parameters every five years for changes that may affect risk. The no action alternative does not include sampling and analysis activities.

Overall Protection of Human Health and the Environment

This alternative poses no risk to human health. Homeland security restrictions prohibit unauthorized boat traffic within 500 feet of the NAS Pensacola shoreline. LTSM would continue to monitor for changes in site conditions that could affect risk conditions described in the BRA.

Compliance with ARARs

LTSM complies with all ARARs. Sediment would be anticipated to reach remedial goals with time through natural processes. The long-term monitoring plan would set forth specific progress goals. If goals are not met, a decision would have to be made as to whether or not to abandon LTSM in favor of another alternative.

Long-Term Effectiveness and Permanence

The long-term effectiveness of LTSM is supported by the following factors:

- Natural sedimentation may be occurring in the area of concern and may eventually bury the contaminated material. If needed, a groin or breakwater could be constructed to enhance natural deposition over the area. This possibility would be contingent on minimizing the obstruction of navigational channels.

- Organisms at Site 2 could transform or degrade organic COPCs to less toxic forms via bioprocesses. Intrinsic bioremediation, even of these persistent (organic) compounds, occurs naturally but slowly in sediments, and uses indigenous microorganisms and enzymatic pathways of both aerobic and anaerobic processes. As natural sedimentation and/or transformation of the chemicals occur, other less opportunistic species in the bay may begin to move into the area naturally (Bishop, 1996).

- Additional testing may allow refinement of the risk assessment and show a reduced level of risk, which does not require further remedial action.

Other advantages of LTSM include no disturbance of the sediments and continued minimization of the water column from groundwater infiltration. Not disturbing the sediments would eliminate the risk of releasing sediment bound contaminants into the water column. Contaminants in infiltrating groundwater may also be prevented from entering into the surface water column as heavily reduced sediments are typically capable of removing inorganic and organic compounds through binding and reductive processes.

Reduction of Toxicity, Mobility, or Volume through Treatment

LTSM does not reduce toxicity, mobility or volume through treatment, and does not satisfy the statutory preference for treatment as a principal element. COPCs would remain in place, and no treatment would be effected during remedial actions; however, natural degradation of COPCs or burial of site sediments could occur, and toxicity could decrease with time.

Short-Term Effectiveness

Access controls are currently in place at Site 2.

In the short-term, this plan would not change current risks to the ecology. Industrial discharges from Site 38 have been eliminated. Sewer outfalls have been out of service for at least 18 years. Unlike capping or dredging, LTSM would not exterminate benthic organisms in the application area.

Implementability

LTSM is technically feasible and easily implemented. A monitoring program would need to be developed. Institutional controls, including military security and the intra-coastal waterway navigational channel, adequately restrict human access.

Cost

The LTSM cost is detailed in Section 2.4.4. The estimated direct initial and subsequent monitoring costs are $64,000 and $32,000, respectively. LTSM would be conducted every five years. The estimated 30-year present value for the LTSM alternative is $227,000, assuming a 6% discount rate and including a 30% contingency.

State Acceptance

The Navy has involved FDEP and USEPA throughout the entire remedial process. FDEP will have the opportunity to review and comment on this FFSA.

Community Acceptance

The status of community acceptance for the long-term sediment monitoring alternative will be established after the public comment period for the FFSA.

4.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides a comparative analysis of alternatives, examining potential advantages and disadvantages of each according to the nine criteria stipulated in the NCP.

4.1 Threshold Criteria

All alternatives considered for selection must comply with the threshold criteria: overall protection of human health and the environment and ARARs.

4.1.1 Overall Protection of Human Health and the Environment

This criterion evaluates the overall degree of protectiveness afforded to human health and the environment. It assesses the overall adequacy of each alternative.

Protection of Human Health

The BRA indicates no human health risks are expected at Site 2 from sediment contamination. Access controls are currently enforced at the site and there is no direct contact between workers and/or residents and the site sediment.

Protection of the Environment

The ecological risk assessment employed the use of the SQT approach to evaluate risk to potential receptors in the marine environment. The SQT approach combines the measures of potential impacts with laboratory measures of the effects and the study of resident communities (see Section 4 of the Final RI Report Addendum, EnSafe, 2004). Tools used to identify COPCs included the SQGs (ERLs, ERMs, PELs, and TELs) and SEM/AVS. Using the SQG tool, it was determined that none of the DUs fell into the category of having acute and chronic bioassay effects and low benthic diversity indicating impact. DU08 and DU11 were determined to have conditions where toxic chemicals were probably stressing the system, which is termed Condition 6. However, DU08 and DU11 were found to have high benthic diversity, evenness, and richness indicies; and no observed effects with the epibenthic mysid for survival, growth, or fecundity. DU08 and DU11 also outperformed the reference stations used for the sublethal growth endpoint in the amphipod test.

Each of the four alternatives protects the environment in varying degrees. No action allows the environment to continue to function undisturbed. Capping or dredging afford long-term protection of the environment, but will exterminate benthic organisms in the application area (benthic organisms would gradually re-colonize the area). LTSM would monitor for changes in the sedimentary environment in anticipation of decreasing risk via natural processes.

4.1.2 Compliance with ARARs

As discussed in Section 1, no threats to human health are present at Site 2. If physical controls continue to be implemented at the site, no further action will be required at Site 2 to protect human health.

Alternatives 1 and 4 comply with ARARs. Compliance with action- and location-specific ARARs for alternatives 2 and 3 is attainable.

As outlined in the NCP, onsite remedial actions selected in the ROD must attain those ARARs identified at the time of the ROD signature or provide grounds for invoking a waiver under 300.430(f)(1)(ii)(C) (or CERCLA 121[d][4]).

4.2 Primary Balancing Criteria

Five primary balancing criteria typically highlight the major differences between alternatives. These criteria include the following:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

4.2.1 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion assesses the results of a remedial action in risk remaining at the site, particularly the magnitude of residual risk and the adequacy and reliability of controls.

Magnitude of Residual Risk

As stated in the BRA, no risk is posed to human health at Site 2. Alternative 1 has no long-term effectiveness. Alternative 2 reduces risk by preventing contact between benthic organisms and the site sediment. Risk to the environment is eliminated in Alternative 3 by removing sediments identified as likely causing an adverse effect. Alternative 4's long-term effectiveness is based on evaluation of natural processes with actions identified contingent upon site conditions. Because of this, Alternative 4 can only be estimated as more effective than Alternative 1 but less effective than Alternatives 2 and 3.

Adequacy and Reliability of Controls

Controls inherent to Site 2 include a concrete seawall, limited access, and restrictions on recreational use. No further actions are required to protect human health at Site 2 under the current-use scenario.

Alternative 2 provides slightly more reliable controls than the no action and LTSM alternatives. The completed cap will reduce the threat to future biota in that area of the bay; however, the cap could require annual maintenance to ensure contact with the site sediment is restricted. Alternative 3 provides the most reliability, because sediment is removed from the site; however, long-term liability will be incurred by the Navy through disposal at a landfill. Although potentially contaminated subsurface sediments would be exposed, they would be covered with a 12-inch sand replacement cover.

4.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 1, 3, and 4 do not reduce toxicity, mobility, or volume of contaminants through treatment. Alternative 2 could reduce mobility by preventing sediment migration and immobilizing metals by promoting reducing conditions.

4.2.3 Short-Term Effectiveness

No short-term effectiveness issues are associated with Alternatives 1 or 4. Alternatives 2 and 3 would exterminate benthic organisms in the application area. In these alternatives, exposure to workers and the area around Site 2 can be controlled with engineering controls and use of proper personal protective equipment. Duration of field activities for both Alternatives 2 and 3 would likely be less than 3 months.

4.2.4 Implementability

All four alternatives are implementable, technically and administratively. Capping would require a remedial design investigation before implementation. Velocities and directions of currents and the potential for possible erosion of the cap need to be evaluated. Dredging would require dewatering and transportation of sediment to an offsite facility; however, these alternatives do not require extraordinary services or materials. Permits would need to be obtained for both the dredging and capping alternatives before implementation can take place. The LTSM alternative would require monitoring and a management plan for making decisions about how monitoring results would affect future actions at the site.

4.2.5 Cost

Direct, O&M, indirect, and present value costs for all four alternatives are presented in Table 4-1. Note that costs for Alternative 2 (Capping) are significantly linked to erosional/depositional patterns. Further field investigation will be required to collect data to effectively evaluate costs associated with this alternative.

4.3 Modifying Criteria

Community acceptance will be established after the public comment period for the FFSA.

Table 4-1
Cost Comparison for Alternatives

Alternative	Variables	Direct Costs	O&M Costs	Indirect Costs[a]	Total Present Value[b]
Alternative 1: No Action	Conduct 5-year reviews for 30 years	$10,000	$24,400	$10,200	$45,000
Alternative 2: Capping	25% material loss & refurbishment every 10 years	$765,200	$457,200	$611,100	$1,834,000
Alternative 3: Dredging and Offsite Disposal	1-foot excavation depth and replacement cover	$855,000	$0	$427,000	$1,283,000
Alternative 4: LTSM	Initial event + monitoring at 5-year intervals for 30 years	$64,000	$78,100	$85,300	$227,000

Notes:
a = Indirect costs include 30% contingency, contractor reporting requirements, and overhead and profit; except for the no-action alternative, which has a 10% contingency. The indirect costs are assumed to be a percentage of the total direct and O&M costs.
b = Present value is based on 30-years' operation and maintenance using a 6% discount rate.

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6.0 FLORIDA PROFESSIONAL GEOLOGIST SEAL

I have read and approve of this FFSA for NAS Pensacola Site 2 (Operable Unit 3) and seal it in accordance with Chapter 492 of the Florida Statutes. In sealing this document, I certify the geological information contained in it is true to the best of my knowledge and the geological methods and procedures included herein are consistent with currently accepted geological practices.

Name:	Brian E. Caldwell
License Number:	1330
State:	Florida
Expiration Date:	July 31, 2006

B Caldwell

Brian E. Caldwell

9/27/04

Date

7.0 FLORIDA PROFESSIONAL ENGINEERS SEAL

I am registered to practice engineering by the Florida State Board of Professional Examiners (License No. 50413). I certify, under penalty of law, that the Focused Feasibility Study for Naval Air Station Pensacola Site 2 (Operable Unit 3) was performed in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, the information submitted is true, accurate, and complete; the contents of this document are consistent with currently accepted engineering practices. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violatbns.

Name: Elizabeth Claire Barnett
License Number: 50413
State: Florida
Expiration Date: February 28, 2005

Elizabeth Claire Barnett
Elizabeth Claire Barnett

10-1-04
Date

Appendix A

Applicable or Relevant and Appropriate Requirements

Table A-1
Summary of Potential Action-Specific ARARs
NAS Pensacola Site 2

ARAR	Status	Description	Application
State Requirements			
FR 62-312 Dredge and Fill Activities	Applicable	Describes permitting and review process for dredge activities	Applicable if Alternatives 2 or 3 are selected.
FR 62-45 25-year Permits for Maintenance of Dredging in Deepwater Ports	Relevant	Applies to dredging activities in deepwater ports	Relevant if this area is deemed and continues to be part of a deepwater port.
Federal Requirements			
33 CFR 320	Applicable	Gives U.S. Corps of Engineers (USACE) authority to regulate actions in navigable waterways, including dredging.	Applicable if Alternatives 2 or 3 are selected.
33 CFR 322	Applicable	Contains USACE permitting structure for work in or affecting navigable waters of the United States	Applicable if Alternatives 2 or 3 are selected.

Appendix B

Conceptual Cost Estimate

Table B-1
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Alternative 1: No Action
NAS Pensacola

Table B-5 Ref. No.	Item	Cost
	Initial No-Action Alternative Evaluation Costs	
NA	Engineering and Design	$10,000
	Subtotal Initial Costs	**$10,000**
	Subsequent No-Action Alternative Evaluation Costs	
NA	Engineering and Design	$10,000
	Event Frequency (Years)	5
	Operational Period (Years)	30
	Discount Rate	6%
	Subtotal Present Value Monitoring Costs (6% Discount Rate)	**$24,418**
	Total Present Value Direct Costs	**$34,418**
	Contingency (10%)	$3,442
	Contractor Reporting Requirements (10%)	$3,442
	Overhead and Profit (10%)	$3,442
	Total Cost for Alternative 1	$44,744
	Total Cost for Alternative 1 (Rounded to the Nearest $1,000)	**$45,000**

Table B-2
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Alternative 2: In Situ Underwater Cap
NAS Pensacola

Table B-5 Ref. No.	Item	Cost
	Construction Costs	
1001	Materials	$59,944
1002	Equipment	$567,443
1003	Labor	$58,691
1004	Field Office	$388
1005	Analyses	$9,153
	Subtotal Construction Costs	$695,620
	Engineering and Design (10%)	$69,562
	Subtotal Loaded Construction Costs	**$765,182**
	Monitoring Costs	
1006	Materials	$985
1007	Labor	$4,675
1008	Field Office	$310
1009	Analyses	$9,153
	Subtotal Monitoring Costs	$15,122
	Event Frequency (Years)	1
	Operational Period (Years)	30
	Discount Rate	6%
	Subtotal Present Value Monitoring Costs (6% Discount Rate)	**$208,150**
	Refurbishment Costs	
1010	Materials	$14,986
1011	Equipment	$217,582
1012	Labor	$18,139
1013	Field Office	$310
1014	Analyses	$9,153
	Subtotal Refurbishment Costs	$260,170
	Engineering and Design (10%)	$26,017
	Subtotal Loaded Refurbishment Costs	$286,187
	Refurbishment Frequency (Years)	10
	Operational Period (Years)	30
	Number of Refurbishments	2
	Discount Rate	6%
	Subtotal Present Value Refurbishment Costs (6% Discount Rate)	**$249,040**
	Total Present Value Direct Costs	**$1,222,372**
	Contingency (30%)	$366,712
	Contractor Reporting Requirements (10%)	$122,237
	Overhead and Profit (10%)	$122,237
	Total Cost for Alternative 2	$1,833,558
	Total Cost for Alternative 2 (Rounded to the Nearest $1,000)	**$1,834,000**

Table B-3
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Alternative 3: Dredging and Offsite Disposal
NAS Pensacola

Table B-5 Ref. No.	Item	Cost
	Construction and Disposal Costs	
2001	Dredging, Dewatering, and Staging Materials	$1,598
2002	Dredging, Dewatering, and Staging Equipment	$256,886
2003	Dredging, Dewatering, and Staging Labor	$66,214
2004	Dredging, Dewatering, and Staging Field Office	$530
2005	Dredging, Dewatering, and Staging Analyses	$3,022
3001	Replacement Cover Materials	$17,783
3002	Replacement Cover Equipment	$275,810
3003	Replacement Cover Labor	$21,237
3004	Replacement Cover Field Office	$388
3005	Replacement Cover Analyses	$753
4001	Offsite Disposal Transportation	$27,065
4002	Offsite Disposal Disposal Costs	$98,757
4003	Offsite Disposal Analyses	$7,241
	Subtotal Construction and Disposal Costs	$777,283
	Engineering and Design (10%)	$77,728
	Subtotal Loaded Construction and Disposal Costs	**$855,012**
	Total Present Value Direct Costs	**$855,012**
	Contingency (30%)	$256,504
	Contractor Reporting Requirements (10%)	$85,501
	Overhead and Profit (10%)	$85,501
	Total Cost for Alternative 3	$1,282,518
	Total Cost for Alternative 3 (Rounded to the Nearest $1,000)	**$1,283,000**

Table B-4
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Alternative 4: Long-Term Sediment Monitoring
NAS Pensacola

Table B-5 Ref. No.	Item	Cost
	Initial Monitoring Costs	
5001	Equipment	$1,665
5002	Labor	$7,066
5003	Analyses	$23,271
	Subtotal Initial Monitoring Costs	$32,002
	Engineering and Design (100%)	$32,002
	Subtotal Initial Costs	**$64,004**
	Subsequent Monitoring Costs	
5001	Equipment	$1,665
5002	Labor	$7,066
5003	Analyses	$23,271
	Subtotal Monitoring Costs	$32,002
	Event Frequency (Years)	5
	Operational Period (Years)	30
	Discount Rate	6%
	Subtotal Present Value Subsequent Monitoring Costs (6% Discount Rate)	**$78,143**
	Total Present Value Direct Costs	**$142,147**
	Contingency (30%)	$42,644
	Contractor Reporting Requirements (20%)	$28,429
	Overhead and Profit (10%)	$14,215
	Total Cost for Alternative 4	$227,435
	Total Cost for Alternative 4 (Rounded to the Nearest $1,000)	**$227,000**

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

Insitu Underwater Cap Construction

Ref. No.	Item	Unit Cost	Unit	Quantity	Total Cost	Reference	Notes
	Construction Costs (Safety Level D)						
	Materials						
100	Sand, 6" Lifts, Offsite	$10.67	CY	1,667	$17,783	ECHOS 2001, 17 03 0426	1 ft of sand used in 2 ft insitu underwater cap
101	Gravel, 6" Lifts	$10.45	CY	1,667	$17,417	ECHOS 2001, 17 03 0430	1 ft of gravel used in 2 ft insitu underwater cap
102	Rock Cover, Rip-rap, Heavy (25 - 500-lb pieces)	$22.27	CY	1,111	$24,744	ECHOS 2001, 18 05 0204	Rip-rap facing (25 sf/ft) for 1200 ft cap perimeter
1001					**$59,944**		
	Equipment						
103	Mobilization/demobilization of barge and placement equipment	$100,000.00	LS	1	$100,000	Vendor estimate: M&N Dredging at (850) 265-5133	Assuming placement in 20 ft of water
104	Emplace cap materials from barge	$100.00	CY	4,444	$444,444	Vendor estimate: M&N Dredging at (850) 265-5133	Placement of 45000-SF underwater cap to 2 ft depth and 1200 ft rip-rap facing (25 SF/FT); Assuming placement in 20 ft of water
105	950, 3.0 CY Wheel Loader	$84.04	HR	111	$9,338	ECHOS 2001, 17 03 0223	Load offsite cap materials from truck to barge
106	Standby, 950, 3.0 CY Wheel Loader	$12.24	HR	37	$453	ECHOS 2001, 17 03 0348	25% downtime
107	0.75-Y Backhoe with Front End Loader	$82.81	HR	111	$9,201	ECHOS 2001, 17 03 0437	Load offsite cap materials from truck to barge
108	Standby, 0.75-CY Backhoe with Front End Loader	$64.58	HR	37	$2,392	ECHOS 2001, 17 03 0442	25% downtime
109	Van or Pickup Rental	$35.00	DAY	21	$735	ECHOS 2001, 33 01 0102	
110	Boat with Motor, Daily Rental	$135.00	DAY	3	$405	ECHOS 2001, 33 02 0522	Used to collect geotechnical samples
111	Bottom Sampler, 17-lb Stainless Steel, 6" x 6" x 6" with 100' Cable	$474.50	EA	1	$475	ECHOS 2001, 33 02 0531	
1002					**$567,443**		
	Labor						
900	Senior Project Manager (Loaded by Factor of 2)	$94.52	HR	6	$567	ECHOS 2001, 33 22 0101	2 hrs/wk x 3 wks
901	Project Manager (Loaded by Factor of 2)	$87.20	HR	48	$4,186	ECHOS 2001, 33 22 0102	16 hrs/wk x 3 wks
903	Senior Staff Engineer (Loaded by Factor of 2)	$76.90	HR	180	$13,842	ECHOS 2001, 33 22 0104	60 hrs/wk x 3 wks
908	Staff Scientist (Loaded by Factor of 2)	$51.32	HR	180	$9,238	ECHOS 2001, 33 22 0109	60 hrs/wk x 3 wks
909	QA/QC Officer (Loaded by Factor of 2)	$68.54	HR	24	$1,645	ECHOS 2001, 33 22 0110	8 hrs/wk x 3 wks
910	Certified Industrial Hygienist (Loaded by Factor of 2)	$69.34	HR	6	$416	ECHOS 2001, 33 22 0111	2 hrs/wk x 3 wks
916	Equipment Operator (Loaded by Factor of 2)	$67.00	HR	329	$22,058	ECHOS 2001, 99 01 0202	Total heavy equipment operating time, 10% downtime allowable
921	Mobilize Crew, 250 miles per Person	$218.88	EA	4	$876	ECHOS 2001, 33 01 0203	1 Sr Staff Engr, 1 Staff Scientist, 2 Equipment Operators
923	Per Diem	$85.00	MAN-DAY	69	$5,865	FTR	
1003					**$58,691**		
	Field Office						
925	Office Equipment	$142.00	MO	0	$0	ECHOS 1997, 010 034 0100	
926	Office Supplies	$91.50	MO	1	$92	ECHOS 1997, 010 034 0120	
927	Computer Rental	$218.54	MO	1	$219	ECHOS 2001, 33 02 9926	
929	Portable Toilets - Chemical	$78.31	MO	1	$78	ECHOS 2001, 99 04 0501	
1004					**$388**		
	Analyses						
112	Hydrographic Survey	$8,400.00	EA	1	$8,400	Vendor Est. (Arc Surveying & Mapping Inc., at (904) 384-8377)	Field services ($1,800/day): 1 day for controls, 1 day for each 150' x 150' decision unit, 1 day for mob/demob; Office services ($600/day): 2 days for data reduction/presentation
113	Geotechnical Characteristics Analysis	$125.43	EA	6	$753	ECHOS 2001, 33 02 1101	Determine grain size analysis; 3 samples collected per 150' x 150' decision unit
1005					**$9,153**		
	Monitoring Costs (Safety Level D)						
	Equipment						
114	Van or Pickup Rental	$35.00	DAY	3	$105	ECHOS 2001, 33 01 0102	
115	Boat with Motor, Daily Rental	$135.00	DAY	3	$405	ECHOS 2001, 33 02 0522	Used to collect geotechnical samples
116	Bottom Sampler, 17 Lb Stainless Steel, 6"x6"x6", with 100' Cable	$474.50	EA	1	$475	ECHOS 2001, 33 02 0531	
1006					**$985**		
	Labor						
900	Senior Project Manager (Loaded by Factor of 2)	$94.52	HR	1	$95	ECHOS 2001, 33 22 0101	
901	Project Manager (Loaded by Factor of 2)	$87.20	HR	4	$349	ECHOS 2001, 33 22 0102	
903	Senior Staff Engineer (Loaded by Factor of 2)	$76.90	HR	24	$1,846	ECHOS 2001, 33 22 0104	Sampler
908	Staff Scientist (Loaded by Factor of 2)	$51.32	HR	24	$1,232	ECHOS 2001, 33 22 0109	Sampler
909	QA/QC Officer (Loaded by Factor of 2)	$68.54	HR	2	$137	ECHOS 2001, 33 22 0110	
910	Certified Industrial Hygienist (Loaded by Factor of 2)	$69.34	HR	1	$69	ECHOS 2001, 33 22 0111	
921	Mobilize Crew, 250 miles per Person	$218.88	EA	2	$438	ECHOS 2001, 33 01 0203	1 Sr Staff Engr, 1 Staff Scientist
923	Per Diem	$85.00	MAN-DAY	6	$510	FTR	

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

1007					**$4,675**		
	Field Office						
925	Office Equipment	$142.00	MO	0	$0	ECHOS 1997, 010 034 0100	
926	Office Supplies	$91.50	MO	1	$92	ECHOS 1997, 010 034 0120	
927	Computer Rental	$218.54	MO	1	$219	ECHOS 2001, 33 02 9926	
929	Portable Toilets - Chemical	$78.31	MO	0	$0	ECHOS 2001, 99 04 0501	
1008					**$310**		
	Analyses						
117	Hydrographic Survey	$8,400.00	EA	1	$8,400	Vendor Est. (Arc Surveying & Mapping Inc., at (904) 384-8377)	Field services ($1,800/day): 1 day for controls, 1 day for each 150' x 150' decision unit, 1 day for mob/demob; Office services ($600/day): 2 days of data reduction/presentation
118	Geotechnical Characteristics Analysis	$125.43	EA	6	$753	ECHOS 2001, 33 02 1101	Determine grain size analysis; 3 samples collected per 150' x 150' decision unit
1009					**$9,153**		

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

	Refurbishment Costs (Safety Level D)						
	Materials						
119	Sand, 6" Lifts, offsite	$10.67	CY	417	$4,446	ECHOS 2001, 17 03 0426	25% replacement; 1 ft of sand used in 2 ftT insitu underwater cap
120	Gravel, 6" Lifts	$10.45	CY	417	$4,354	ECHOS 2001, 17 03 0430	25% replacement; 1 ft of gravel used in 2 ft insitu underwater cap
121	Rock Cover, rip-rap, Heavy (25 to 500 Lb Pieces)	$22.27	CY	278	$6,186	ECHOS 2001, 18 05 0204	25% replacement; Rip-rap facing (25 sf/ft) for 1200 ft cap perimeter
1010					**$14,986**		
	Equipment						
122	Mobilization/demobilization of barge and placement equipment	$100,000.00	LS	1	$100,000	Vendor estimate: M&N Dredging at (850) 265-5133	Assuming placement in 20 ft of water
123	Emplace cap materials from barge	$100.00	CY	1,111	$111,111	Vendor estimate: M&N Dredging at (850) 265-5133	Placement of 25% of 45000 sf underwater cap to 2 ft depth and 25% of 1200 ft rip-rap facing (25 sf/ft); Assuming placement in 20 ft of water
124	950, 3.0 CY, Wheel Loader	$84.04	HR	28	$2,334	ECHOS 2001, 17 03 0223	Load offsite cap materials from truck to barge
125	Standby, 950, 3.0 CY, Wheel Loader	$12.24	HR	9	$113	ECHOS 2001, 17 03 0348	25% downtime
126	0.75 CY Backhoe with Front End Loader	$82.81	HR	28	$2,300	ECHOS 2001, 17 03 0437	Load offsite cap materials from truck to barge
127	Standby, 0.75 CY Backhoe with Front End Loader	$64.58	HR	9	$598	ECHOS 2001, 17 03 0442	25% downtime
128	Van or Pickup Rental	$35.00	DAY	7	$245	ECHOS 2001, 33 01 0102	
129	Boat with Motor, Daily Rental	$135.00	DAY	3	$405	ECHOS 2001, 33 02 0522	Used to collect geotechnical samples
130	Bottom Sampler, 17 Lb Stainless Steel, 6"x6"x6", with 100' Cable	$474.50	EA	1	$475	ECHOS 2001, 33 02 0531	
1011					**$217,582**		
	Labor						
900	Senior Project Manager (Loaded by Factor of 2)	$94.52	HR	2	$189	ECHOS 2001, 33 22 0101	2 hrs/wk x 1 wk
901	Project Manager (Loaded by Factor of 2)	$87.20	HR	16	$1,395	ECHOS 2001, 33 22 0102	16 hrs/wk x 1 wk
903	Senior Staff Engineer (Loaded by Factor of 2)	$76.90	HR	60	$4,614	ECHOS 2001, 33 22 0104	60 hrs/wk x 1 wk
908	Staff Scientist (Loaded by Factor of 2)	$51.32	HR	60	$3,079	ECHOS 2001, 33 22 0109	60 hrs/wk x 1 wk
909	QA/QC Officer (Loaded by Factor of 2)	$68.54	HR	8	$548	ECHOS 2001, 33 22 0110	8 hrs/wk x 1 wk
910	Certified Industrial Hygienist (Loaded by Factor of 2)	$69.34	HR	2	$139	ECHOS 2001, 33 22 0111	2 hrs/wk x 1 wk
916	Equipment Operator (Loaded by Factor of 2)	$67.00	HR	82	$5,514	ECHOS 2001, 99 01 0202	Total heavy equipment operating time, 10% downtime allowable
921	Mobilize Crew, 250 miles per Person	$218.88	EA	4	$876	ECHOS 2001, 33 01 0203	1 Sr Staff Engr, 1 Staff Scientist, 2 Equipment Operators
923	Per Diem	$85.00	MAN-DAY	21	$1,785	FTR	
1012					**$18,139**		
	Field Office						
925	Office Equipment	$142.00	MO	0	$0	ECHOS 1997, 010 034 0100	
926	Office Supplies	$91.50	MO	1	$92	ECHOS 1997, 010 034 0120	
927	Computer Rental	$218.54	MO	1	$219	ECHOS 2001, 33 02 9926	
929	Portable Toilets - Chemical	$78.31	MO	0	$0	ECHOS 2001, 99 04 0501	
1013					**$310**		
	Analyses						
131	Hydrographic Survey	$8,400.00	EA	1	$8,400	Vendor Est. Arc Surveying & Mapping Inc. at (904) 384-8377	Field services ($1,800/day): 1 day for controls, 1 day for each 150' x 150' decision unit, 1 day for mob/demob; Office services ($600/day): 2 days for data reduction/presentation
132	Geotechnical Characteristics Analysis	$125.43	EA	6	$753	ECHOS 2001, 33 02 1101	Determine grain size analysis; 3 samples collected per 150'x150' decision unit
1014					**$9,153**		

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

Dredging, Dewatering, and Staging

Ref. No.	Item	Unit Cost	Unit	Quantity	Total Cost	Reference	Notes
	Construction Costs (Safety Level D)						
	Materials						
200	30 Mil Polymeric Liner, PVC	$1.19	SF	950	$1,131	ECHOS 2001, 33 08 0572	Staging pile constructed to hold 10% of dredged soil to 10 ft thick + 500 sf loading area
201	Polymeric Liner Anchor Trench, 3' x 1.5'	$0.78	LF	123	$96	ECHOS 2001, 33 08 0503	Square staging pile constructed
202	Sand, 6" Lifts, offsite	$10.67	CY	18	$188	ECHOS 2001, 17 03 0426	6-in sand overlying PVC liner
203	Gravel, 6" Lifts	$10.45	CY	18	$184	ECHOS 2001, 17 03 0430	6-in gravel overlying sand, overlying PVC liner
2001					**$1,598**		
	Equipment						
204	Mobilize/demobilize 6-person dive crew (2-divers) for dredging	$2,000.00	LS	1	$2,000	Vendor estimate: Onyx Industrial Services at (304) 965-9630	
205	Dredging dive crew (6-person, 2-divers)	$7,000.00	DAY	14	$98,000	Vendor estimate: Onyx Industrial Services at (304) 965-9630	Fully-loaded dredge crew, 12-hr day, pumps and hoses
206	Moblization/demobilization of filter press, activated carbon water treatment equipment, and associated hoses	$26,308.00	LS	1	$26,308	Vendor estimate: Onyx Industrial Services at (304) 965-9630	
207	Equipment Setup/Breakdown (3-Days)	$19,305.00	LS	1	$19,305	Vendor estimate: Onyx Industrial Services at (304) 965-9630	
208	Filter Press, Water Treatment Processing	$80,758.00	LS	1	$80,758	Vendor estimate: Onyx Industrial Services at (304) 965-9630	Based on continuous process treatment of dredge of two 150' x 150' decision units to 1 foot
209	950, 3.0 CY, Wheel Loader	$84.04	HR	168	$14,119	ECHOS 2001, 17 03 0223	14 days, 12 hrs/day
210	0.75 CY Backhoe with Front End Loader	$82.81	HR	168	$13,912	ECHOS 2001, 17 03 0437	14 days, 12 hrs/day
211	Spread/Compact Large Areas, 6" Lifts, D8 & Towed Sheepsfoot	$0.67	CY	35	$24	ECHOS 2001, 17 03 0517	Spread/compact staging area liner
212	Van or Pickup Rental	$35.00	DAY	14	$490	ECHOS 2001, 33 01 0102	
213	Decontaminate Heavy Equipment	$300.67	EA	2	$601	ECHOS 2001, 33 17 0803	1-Wheel Loader, 1-Backhoe
214	Van or Pickup Rental	$35.00	DAY	14	$490	ECHOS 2001, 33 01 0102	
215	Boat with Motor, Daily Rental	$135.00	DAY	3	$405	ECHOS 2001, 33 02 0522	Used to collect sludge samples for dewatering characteristics
216	Bottom Sampler, 17 Lb Stainless Steel, 6"x6"x6", with 100' Cable	$474.50	EA	1	$475	ECHOS 2001, 33 02 0531	
2002					**$256,886**		
	Labor						
900	Senior Project Manager (Loaded by Factor of 2)	$94.52	HR	6	$567	ECHOS 2001, 33 22 0101	2 hrs/wk x 3 wks
901	Project Manager (Loaded by Factor of 2)	$87.20	HR	48	$4,186	ECHOS 2001, 33 22 0102	16 hrs/wk x 3 wks
903	Senior Staff Engineer (Loaded by Factor of 2)	$76.90	HR	204	$15,688	ECHOS 2001, 33 22 0104	60 hrs/wk x 3 wks; 3 days for preparatory sludge sample collection
908	Staff Scientist (Loaded by Factor of 2)	$51.32	HR	204	$10,469	ECHOS 2001, 33 22 0109	61 hrs/wk x 3 wks; 3 days for preparatory sludge sample collection
909	QA/QC Officer (Loaded by Factor of 2)	$68.54	HR	24	$1,645	ECHOS 2001, 33 22 0110	8 hrs/wk x 3 wks
910	Certified Industrial Hygienist (Loaded by Factor of 2)	$69.34	HR	6	$416	ECHOS 2001, 33 22 0111	2 hrs/wk x 3 wks
916	Equipment Operator (Loaded by Factor of 2)	$67.00	HR	373	$25,013	ECHOS 2001, 99 01 0202	Total heavy equipment operating time, 10% downtime allowable
921	Mobilize Crew, 250 miles per Person	$218.88	EA	7	$1,532	ECHOS 2001, 33 01 0203	2 Sr Staff Engrs, 2 Staff Scientists, 3 Equipment Operators
923	Per Diem	$85.00	MAN-DAY	79	$6,698	FTR	
2003					**$66,214**		
	Field Office						
924	Temporary Office 50' x 12'	$393.37	MO	0	$0	ECHOS 2001, 99 04 0104	
925	Office Equipment	$142.00	MO	1	$142	ECHOS 1997, 010 034 0100	
926	Office Supplies	$91.50	MO	1	$92	ECHOS 1997, 010 034 0120	
927	Computer Rental	$218.54	MO	1	$219	ECHOS 2001, 33 02 9926	
929	Portable Toilets - Chemical	$78.31	MO	1	$78	ECHOS 2001, 99 04 0501	
2004					**$530**		
	Analyses						
217	Sludge Constituents and Characteristics Analysis Tests, Soil Analysis	$204.81	EA	6	$1,229	ECHOS 2001, 33 02 1730	3 samples collected per 150' x 150' decision unit
218	Organic Vapor Analyzer Rental	$990.83	MO	1	$991	ECHOS 2001, 33 02 0302	
219	Air Monitoring Station	$802.00	EA	1	$802	ECHOS 2001, 33 02 0301	
2005					**$3,022**		

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

Replacement Cover Construction

Ref. No.	Item	Unit Cost	Unit	Quantity	Total Cost	Reference	Notes
	Construction Costs (Safety Level D)						
	Materials						
300	Sand, 6" Lifts, offsite	$10.67	CY	1,667	$17,783	ECHOS 2001, 17 03 0426	1-ft of sand used as replacement cover
3001					**$17,783**		
	Equipment						
301	Mobilization/demobilization of barge and placement equipment	$100,000.00	LS	1	$100,000	Vendor estimate: M&N Dredging at (850) 265-5133	Assuming placement in 20 ft of water
302	Emplace cap materials from barge	$100.00	CY	1,667	$166,667	Vendor estimate: M&N Dredging at (850) 265-5133	Placement of 45000 sf of replacement cover to 1 ft depth
303	950, 3.0 CY, Wheel Loader	$84.04	HR	42	$3,502	ECHOS 2001, 17 03 0223	Load offsite cap materials from truck to barge
304	Standby, 950, 3.0 CY, Wheel Loader	$12.24	HR	14	$170	ECHOS 2001, 17 03 0348	25% downtime
305	0.75 CY Backhoe with Front End Loader	$82.81	HR	42	$3,450	ECHOS 2001, 17 03 0437	Load offsite cap materials from truck to barge
306	Standby, 0.75 CY Backhoe with Front End Loader	$64.58	HR	14	$897	ECHOS 2001, 17 03 0442	25% downtime
307	Van or Pickup Rental	$35.00	DAY	7	$245	ECHOS 2001, 33 01 0102	
308	Boat with Motor, Daily Rental	$135.00	DAY	3	$405	ECHOS 2001, 33 02 0522	Used to collect geotechnical samples
309	Bottom Sampler, 17 Lb Stainless Steel, 6"x6"x6", with 100' Cable	$474.50	EA	1	$475	ECHOS 2001, 33 02 0531	
3002					**$275,810**		
	Labor						
900	Senior Project Manager (Loaded by Factor of 2)	$94.52	HR	2	$189	ECHOS 2001, 33 22 0101	2 hrs/wk x 1 wk
901	Project Manager (Loaded by Factor of 2)	$87.20	HR	16	$1,395	ECHOS 2001, 33 22 0102	16 hrs/wk x 1 wk
903	Senior Staff Engineer (Loaded by Factor of 2)	$76.90	HR	60	$4,614	ECHOS 2001, 33 22 0104	60 hrs/wk x 1 wk
908	Staff Scientist (Loaded by Factor of 2)	$51.32	HR	60	$3,079	ECHOS 2001, 33 22 0109	60 hrs/wk x 1 wk
909	QA/QC Officer (Loaded by Factor of 2)	$68.54	HR	8	$548	ECHOS 2001, 33 22 0110	8 hrs/wk x 1 wk
910	Certified Industrial Hygienist (Loaded by Factor of 2)	$69.34	HR	2	$139	ECHOS 2001, 33 22 0111	2 hrs/wk x 1 wk
916	Equipment Operator (Loaded by Factor of 2)	$67.00	HR	123	$8,272	ECHOS 2001, 99 01 0202	Total heavy equipment operating time, 10% downtime allowable
921	Mobilize Crew, 250 miles per Person	$218.88	EA	4	$876	ECHOS 2001, 33 01 0203	1 Sr Staff Engr, 1 Staff Scientist, 2 Equipment Operators
923	Per Diem	$85.00	MAN-DAY	25	$2,125	FTR	
3003					**$21,237**		
	Field Office						
925	Office Equipment	$142.00	MO	0	$0	ECHOS 1997, 010 034 0100	
926	Office Supplies	$91.50	MO	1	$92	ECHOS 1997, 010 034 0120	
927	Computer Rental	$218.54	MO	1	$219	ECHOS 2001, 33 02 9926	
929	Portable Toilets - Chemical	$78.31	MO	1	$78	ECHOS 2001, 99 04 0501	
3004					**$388**		
	Analyses						
310	Geotechnical Characteristics Analysis	$125.43	EA	6	$753	ECHOS 2001, 33 02 1101	Determine grain size analysis; 3 samples collected per 150' x 150' decision unit
3005					**$753**		

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

Offsite Disposal

Ref. No.	Item	Unit Cost	Unit	Quantity	Total Cost	Reference	Notes
	Transportation Costs (Safety Level D)						
400	Transport Bulk Solid Hazardous Waste, Max 20 CY	$1.70	MILE	13,200	$22,440	ECHOS 2001, 33 19 0205	Transport of hazardous waste to RCRA Subtitle D disposal facility; 120 mile one-way haul distance
401	Overnight Demurrage	$624.87	EA	3	$1,875	ECHOS 2001, 33 19 0329	In conjunction with 24-hr TOT confirmation sampling of 5% of 20 CY truckloads
402	Truck Washout/Decontamination	$150.00	EA	18	$2,750	ECHOS 2001, 33 19 0311	55 round-trip hauls; 1 day round-trip haul, 3 days of operation
4001					**$27,065**		
	Disposal Costs						
403	Landfill Nonhazardous Solid Bulk Waste	$91.16	CY	1,083	$98,757	ECHOS 2001, 33 19 7270	RCRA Subtitle D facility; Sediment dewatered to 65% solids content
404	Landfill Hazardous Solid Bulk Waste	$144.20	CY	0	$0	ECHOS 2001, 33 19 7264	RCRA Subtitle C facility; Not used, shown for comparison
405	State HTW Disposal Tax/Fee (Bulk Solid)	$77.25	CY	0	$0	ECHOS 2001, 33 19 0324	Navy assumed exempt to state texas
4002					**$98,757**		
	Analyses						
405	TCLP (RCRA) (EPA 1311), Soil Analysis, 24-72 hr CLP	$1,366.00	EA	3	$4,098	ECHOS 2001, 33 02 1702	5-pt composite for 5% of the 55 20 cy truckloads, 24-hr TOT, CLP QA/QC
406	Semi-Volatile Organics, GC/MS (SW8270C), with prep, Soil Analysis, 24-72 hr CLP	$667.44	EA	3	$2,002	ECHOS 2001, 33 02 1739	5-pt composite for 5% of the 55 20 cy truckloads, 24-hr TOT, CLP QA/QC
407	Pesticides/PCBs (SW3550B / SW8081/8082), Soil Analysis, 24-72 hr CLP	$380.07	EA	3	$1,140	ECHOS 2001, 33 02 1717	5-pt composite for 5% of the 55 20 cy truckloads, 24-hr TOT, CLP QA/QC
4003					**$7,241**		

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

Sediment Monitoring

Ref. No.	Item	Unit Cost	Unit	Quantity	Total Cost	Reference	Notes
	Operational Costs (Safety Level D)						
	Equipment						
500	Van or Pickup Rental	$35.00	DAY	7	$245	ECHOS 2001, 33 01 0102	
501	Boat with Motor, Daily Rental	$135.00	DAY	7	$945	ECHOS 2001, 33 02 0522	
502	Bottom Sampler, 17 lb Stainless Steel, 6" x 6" x 6" with 100' Cable	$474.50	EA	1	$475	ECHOS 2001, 33 02 0531	
5001					**$1,665**		
	Labor						
900	Senior Project Manager (Loaded by Factor of 2)	$94.52	HR	1	$95	ECHOS 2001, 33 22 0101	
901	Project Manager (Loaded by Factor of 2)	$87.20	HR	4	$349	ECHOS 2001, 33 22 0102	
903	Senior Staff Engineer (Loaded by Factor of 2)	$76.90	HR	40	$3,076	ECHOS 2001, 33 22 0104	Sampler
908	Staff Scientist (Loaded by Factor of 2)	$51.32	HR	40	$2,053	ECHOS 2001, 33 22 0109	Sampler
909	QA/QC Officer (Loaded by Factor of 2)	$68.54	HR	2	$137	ECHOS 2001, 33 22 0110	
910	Certified Industrial Hygienist (Loaded by Factor of 2)	$69.34	HR	1	$69	ECHOS 2001, 33 22 0111	
921	Mobilize Crew, 250 miles per Person	$218.88	EA	2	$438	ECHOS 2001, 33 01 0203	
923	Per Diem	$85.00	MAN-DAY	10	$850	FTR	
5002					**$7,066**		
	Analyses						
503	Water Quality Parameter Testing Device	$219.00	WK	1	$219	ECHOS 2001, 33 02 1509	Used for field pH/ORP measurements
504	Semi-Volatile Organics, GC/MS (SW8270C), with prep, Soil Analysis, Std TAT, CLP	$389.34	EA	6	$2,336	ECHOS 2001, 33 02 1739	3 samples collected per 150' x 150' decision unit
505	Pesticides/PCBs (SW3550B / SW8081/8082), Soil Analysis, Std TAT, CLP	$221.71	EA	6	$1,330	ECHOS 2001, 33 02 1717	3 samples collected per 150' x 150' decision unit
506	Total Organic Carbon, TOC (EPA 9060), Soil Analysis, Std TAT, CLP	$37.64	EA	6	$226	ECHOS 2001, 33 02 1746	3 samples collected per 150' x 150' decision unit
507	EP Toxicity, Metals (EPA 1310A, TCLP), Soil Analysis, Std TAT, CLP	$280.23	EA	6	$1,681	ECHOS 2001, 33 02 1701	3 samples collected per 150' x 150' decision unit
508	Metal Analysis, Priority 17 Metals, Std TAT, CLP	$88.92	EA	6	$534	ECHOS 2001, 33 02 2124	3 samples collected per 150' x 150' decision unit
509	Total Dissolved Sulfide (EPA 9030B), Soil Analysis, Std TAT, CLP	$24.87	EA	6	$149	ECHOS 2001, 33 02 1742	Used for acid volatile sulfides; 3 samples collected per 150' x 150' decision unit
510	Saltwater Chronic Toxicity Bioassay Analysis, Std TAT, CLP	$2,668.00	EA	2	$5,336	ECHOS 2001, 33 02 1905	Used for 10-day *Leptocheirus plumulosis* and 7-day *Mysidopsis bahia* sediment bioassays; 1 sample collected per 150'x150' decision unit
511	Geotechnical Characteristics Analysis	$125.43	EA	6	$753	ECHOS 2001, 33 02 1101	Determine sedimentation above feldspar markers, grain size analysis, clay content; 3 samples collected per 150'x150' decision unit
512	Vegetation/Soil/Sediment, Gamma Isotopic, Gamma Spectroscopy, Std TAT, CLP	$144.20	EA	16	$2,307	ECHOS 2001, 33 02 2342	Used for Cs-137 dating of soil cores, 8 samples per 2-inch core, 1 core per decision unit
513	Hydrographic Survey	$8,400.00	EA	1	$8,400	Vendor Est. Arc Surveying & Mapping Inc. at (904) 384-8377	Field services ($1,800/day): 1-day for controls, 1-day for each 150'x150' decision unit, 1-day for mob/demob; Office services ($600/day): 2-days data reduction/presentation
5003					**$23,271**		

Table B-5
Conceptual Cost Estimate
Remedies for Contaminated Sediments at Decision Units DU08 and DU11
Detailed Costs
NAS Pensacola

Miscellaneous Unit Costs

Ref. No.	Item	Unit Cost	Unit	Quantity	Total Cost	Reference	Notes
	Unloaded Labor Rates						
900	Senior Project Manager	$47.26	HR			ECHOS 2001, 33 22 0101	
901	Project Manager	$43.60	HR			ECHOS 2001, 33 22 0102	
902	Office Manager	$34.53	HR			ECHOS 2001, 33 22 0103	
903	Senior Staff Engineer	$38.45	HR			ECHOS 2001, 33 22 0104	
904	Project Engineer	$27.84	HR			ECHOS 2001, 33 22 0105	
905	Staff Engineer	$26.02	HR			ECHOS 2001, 33 22 0106	
906	Senior Scientist	$38.45	HR			ECHOS 2001, 33 22 0107	
907	Project Scientist	$26.47	HR			ECHOS 2001, 33 22 0108	
908	Staff Scientist	$25.66	HR			ECHOS 2001, 33 22 0109	
909	QA/QC Officer	$34.27	HR			ECHOS 2001, 33 22 0110	
910	Certified Industrial Hygienist	$34.67	HR			ECHOS 2001, 33 22 0111	
911	Field Technician	$18.95	HR			ECHOS 2001, 33 22 0112	
912	Secretarial/Administrative	$13.90	HR			ECHOS 2001, 33 22 0113	
913	Word Processing/Clerical	$14.57	HR			ECHOS 2001, 33 22 0114	
914	Draftsman/CADD	$19.29	HR			ECHOS 2001, 33 22 0115	
915	Foreman	$35.50	HR			ECHOS 2001, 99 01 0102	Site Project Manager - Avg Cost
916	Equipment Operator	$33.50	HR			ECHOS 2001, 99 01 0202	Superintendent - Avg Cost
917	Uniformed Watchman - Maximum	$14.15	HR			ECHOS 2001, 99 14 1302	
918	Mobilize Crew, Local, per Person	$21.89	EA			ECHOS 2001, 33 01 0206	
919	Mobilize Crew, 50 miles per Person	$65.66	EA			ECHOS 2001, 33 01 0205	
920	Mobilize Crew, 100 miles per Person	$87.55	EA			ECHOS 2001, 33 01 0204	
921	Mobilize Crew, 250 miles per Person	$218.88	EA			ECHOS 2001, 33 01 0203	
922	Mobilize Crew, >= 500 miles per Person	$437.75	EA			ECHOS 2001, 33 01 0201	
923	Per Diem	$85.00	MAN-DAY			FTR	
	Office Equipment						
924	Temporary Office 50' x 12'	$393.37	MO			ECHOS 2001, 99 04 0104	
925	Office Equipment	$142.00	MO			ECHOS 1997, 010 034 0100	
926	Office Supplies	$91.50	MO			ECHOS 1997, 010 034 0120	
927	Computer Rental	$218.54	MO			ECHOS 2001, 33 02 9926	
928	Van or Pickup Rental	$35.00	DAY			ECHOS 2001, 33 01 0102	
929	Portable Toilets - Chemical	$78.31	MO			ECHOS 2001, 99 04 0501	